



Aleksandro  
Stulginskio  
universitetas



**The 8th International Scientific Conference**

**RURAL DEVELOPMENT 2017:**

*Bioeconomy Challenges*

**ABSTRACTS BOOK**

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**Aleksandras Stulginskis University**  
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## **Dear scientists and experts, rural development policy makers and colleagues**

*We are pleased to invite you to participate already in the 8<sup>th</sup> International Scientific Conference ‘**Rural Development 2017: Bioeconomy Challenges**’. It already became as biannual tradition to meet colleagues all over the world here. In addition, we are pleased that this event became a common area for international scientific interdisciplinary discussion on rural development and innovations.*

*It is a pleasure for us to welcome you at Aleksandras Stulginskis University, which is developing due to the challenges of smart growth and bioeconomy. The University is becoming more and more advanced in science and more open to society for cooperation and sharing knowledge.*

*The Mission of University reveals our main aspiration: to develop and disseminate scientific knowledge and sincerely strive for safe and healthy food and full-fledged living environment for all citizens of Lithuania.*

*We are able do more „step by step“ with global changes and innovations by sharing innovative ideas, experience and results of our researches. The existing and rising challenges of bioeconomy will be discussed in different Conference sections:*

- *Biosystems Engineering and Environment Integrity;*
- *Agro-innovations and Food Technologies;*
- *Multifunctional Approach for Sustainable Use of Natural Bio-Resources;*
- *Social Innovations for Rural Development.*

*Together we can create synergy from broad participation from different sectors of the society, the scientists, practitioners, policy makers, private sector actors, NGOs, even young researchers and students. All the participants will be awarded the possibility to express their attitude towards the scientific issues related to rural development, especially in the focus of bioeconomy challenges.*

*Prof. dr. Antanas Maziliauskas  
Rector of Aleksandras Stulginskis University,  
Chairperson of Scientific Committee*

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# **AGRO-INNOVATIONS AND FOOD TECHNOLOGIES**

## Nitrogen Fertilisation Influence on Multi-Species Swards Productivity and Botanical Composition

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### Abstract

Field trials were conducted in Latvia on sod calcareous soil (pH<sub>KCl</sub> 6.7, containing available P – 60 mg kg<sup>-1</sup>, K – 144 mg kg<sup>-1</sup>, organic matter content – 24–28 g kg<sup>-1</sup> of soil), with the aim to study forage yield and botanical composition of grass and legume–grass swards, fertilized with three nitrogen rates N0, N60, N120 at two production years. Twelve mixtures were grouped in four sward types: only grasses (G); lucerne (*Medicago sativa*) and grass mixtures (Ms+G); red clover (*Trifolium pratense*) and grass mixtures (Tp+G); and galega (*Galega orientalis*) and grass mixtures (Go+G). Three-cut sward management were used. The legumes in mixtures with grasses of various growth patterns provided continuous green forage production during the whole summer season. On average for three investigation sites, the N fertilizer dose increase from 0 to 120 kg ha<sup>-1</sup> contributed to a significant dry matter (DM) yield increase by 3.55 Mg ha<sup>-1</sup> in the first year of yielding, and by 2.76 Mg ha<sup>-1</sup> in the second year of yielding. Results show substantial decrease in DM yields between first and second year of yielding for swards containing only grass and grass-red clover swards. More stable productivity show swards containing lucerne and galega.

**Key words:** grass mixture, cutting, nitrogen fertilization.

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## Monitoring Crop State of Cereals Using Sentinel 2 Satellite and UAV Images

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### Abstract

High proportion of arable land is typically for agriculture in Czech Republic. Nowadays there is a problem with decrease of livestock production and increase of biofuel production. This problems causes decrease in the level of soil carbon in the soil. Decrease in levels of organic carbon also leads to easier soil degradation by other negative factors (soil erosion, compaction). Organic matter application into soils is the only corrective action. Decomposition of applied organic matter is a problem in the decarburized soils. Organic matter can be supplemented by biological transformation's activators. The objective of this paper is to demonstrate the efficacy activators of organic matter to improve the soil environment. Field trial has been established in this purpose at locality Sloveč in the Central Bohemia Region. Very heavy soil is located on the experimental field. Results of the six variants with application of manure are presented in this paper. PRP Sol (PRP Technologies) was used like soil activator. PRP Fix (PRP Technologies) was used like activator of the biological transformation of manure. Favorable effect on crop state of cereals was observed. This was confirmed by using vegetation indices (using satellite images). They suggest a beneficial effect of application of bio-activators.

**Keywords:** Organic matter activator; manure application; soil properties; vegetation indices.

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## **Main Directions of Development of Spring Wheat Production Agricultural Technologies for Sustainable Arable Farming in the Forest-Steppe Belt of the Middle Volga Region**

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### **Abstract**

The article presents results of studies of influence of controlled and environmental factors on production process of different varieties of spring wheat carried out in different soil and climatic conditions of Middle Volga region.

The forest-steppe area of the Volga region is one of regions of Russia favorable for spring wheat growing by its natural and climatic conditions. Unbalance of nutrition elements in soil, acid soil and predominantly heavy-textured soil hamper the yield growth. Out of all factors vital for plants (light, heat, moisture and nutrition elements) under consideration, providing plants with nutrition elements and moisture are those limiting high crop yields.

Having carried out the analysis of natural resources and genetic potential of the wheat varieties, systems of plant nutrition optimization and influence of their predecessors, we have obtained new data about possibility of increasing the spring durum wheat arable area. We have shown the role of different forms of using nitrogenous fertilizers (on the background of phosphorus – potassium ones) in the increase of productivity and improvement of the spring wheat grain quality. An established optimal norm for Gramma variety spring spelt corn seeding has been established for the conditions of the grey forest soil in the Fore-Kama region of the Republic of Tatarstan and the influence of their nutrition on yield has been found.

**Keywords:** seeding rate, predecessors, spelt corn, varieties, fertilizers, crop yield, Trans-Kama spring wheat



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## **Impact Assessment of the Vermicompost and Peat Extracts of Soil Nutrient Uptake in Potato Plantation**

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### **Abstract**

Peat and vermicompost extracts obtained at two different temperatures were used to determine the effects of extract application on mineral nutrition of potatoes, as well as the influence of plant mineral nutrition status on the yielding capacity was assessed. The field study was established in 2011-2012 in Stende Research Centre, AREI. A goal of this investigation was to study the impact of extracts, which were obtained from the products of organic origin, on the potato plant and tuber capability of soil nutrient uptake and use and potato yield in the conventional and organic growing systems.

The experiment was arranged in 3 replications treatments were arranged randomly. An early- potato cultivar ‘Borodyansky Rozovij’ was selected for the research.

According to the methodology, the treatment with organic product extracts was done. In conventional growing system 6 treatments were used. In organic growing system 4 treatments were used.

In the conventional field the effect of peat and vermicompost extracts had a stimulating effect on macronutrient uptake resulting in increased N, P and Mg content in potatoes. Reduction in Ca content, mainly in treatments with foliar spray, was found. Application of both preparations contributed to Cu and B uptake. The decrease in Fe content and the increase in Mo content were observed in the treatments using peat extract.

In the organic field peat extract application was effective in all treatments. The leaf analysis show that peat and vermicompost preparations enhanced P uptake, but delayed N and K uptake. The difference in effect on micronutrient supply was also observed – the content of Cu and B increased, but that of Mn and Zn decreased after the second foliar spray. The main negative effect of extract application was that low level of Zn in leaves and decreasing Mo status from optimal one in control treatment to low.

Organic product extracts had stimulated effect on macronutrient uptake and resulting in increased N, P and Mg content in potatoes; did not improve plant nutrient supply significantly; stimulated the accumulation of mineral elements in potato tubers

**Keywords:** potato, nutrients, organic product extract

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## Reaction of Winter Wheat Genotypes on the Yellow (Stripe) Rust *Puccinia Striiformis*, Wes

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### Abstract

In recent years yellow rust has been showed a worldwide distribution and have caused significant yield losses in winter wheat. Partly it has been associated with high rates of mutation. Since 2011 in Europe has been showed distinct new lineages – Warrior, Kranich, Warrior(-) that have caused wide epidemics on different cultivars of wheat. Cool and damp weather conditions are conducive the rise of Yellow (stripe) rust *Puccinia striiformis*, Wes which is one of the

most dangerous wheat leaf disease in the last years in Latvia. Yellow rust can reduced yield by 50% in untreated crops. Grain yield losses can be prevented using a combination of varietal resistance and fungicides. Information on winter wheat varieties diversification can help to reduce the risk of spread in high disease pressure situations. Field trials with eight most popular and perspective winter wheat varieties in Latvia were establish in Stende autumn 2016. The trial was designed as two randomized complete blocks (treated and untreated) with three replications. Two applications of fungicides at BBCH 32 (prothioconazol 53 g L<sup>-1</sup>, spiroxamin 224 g L<sup>-1</sup>, tebuconazole 148 g L<sup>-1</sup> - 0.6 L ha<sup>-1</sup> and BBCH 37-39 (bixafen 65 g L<sup>-1</sup>, prothioconazol 130 g L<sup>-1</sup>, fluopyram 65 g L<sup>-1</sup>- 1.5 L ha<sup>-1</sup> were used to control yellow rust. The grain yield and yield components (grain per ear, ear length) was recorded and grain quality such as thousand-kernel weight (TGW), protein and gluten content, volume weight were determinate. Preliminary results indicate that there are difference between genotypes resistance to yellow rust. Grain yield and yield components of all tested varieties was significantly lower (P>0.001) in untreated block.

**Keywords:** yellow rust, wheat, yield, quality

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## Development of the Approaches for Complex Utilization of Beach-Cast Brown Alga (*Fucus vesiculosus*) Biomass, With Obtaining of New Value-Added Products

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### Abstract

The seaweed collected after stranding on beaches of Latvia is underused natural resource, which has a potential as fertilizer in sustainable agriculture. Fast decay of algal biomass washed ashore make difficulties for its storage. The aim of the present study was development of the approach for the processing of brown alga *Fucus vesiculosus* biomass, collected from the Gulf of Riga. The throughout characterization of the chemical composition of *Fucus vesiculosus* has shown, that it is a potential source not only of nitrogen-containing fertilizers, but also of the biologically active compounds. One of the proposed approaches for the processing of the *Fucus vesiculosus* biomass under study include its extraction with organic solvents and  $\text{CaCl}_2$  solution and further use of the extract-free residue as soil organic amendment. The ethyl acetate extract was rich in phenolic compounds ( $430 \pm 30$  GAE mg/g) with high antioxidant activity in DPPH<sup>•</sup> and ABTS<sup>•+</sup> tests, comparable with industrial antioxidants. The ethanol extract contained significant amounts of phlorotannins that was confirmed by the data of LC-MS/MS analysis. The  $\text{CaCl}_2$  extract was used for the obtaining of sulphated polysaccharide fucoidane (yield  $\approx 7\%$ ), which has numerous biological activities. The extract-free residue didn't show any phytotoxicity and was enriched with nitrogen-containing compounds. As alternative approach for processing of the algae biomass, the chemically-mechanical treatment of algae biomass with lignin or lignosilicon was proposed. EPR analyses confirmed interaction between algae biomass and lignin. The obtained algal and lignin complex exhibited positive effect in root elongation tests with fenugreek (*Trigonella foenum-graecum*) and garden cress (*Lepidium sativum*). The strongest positive effect was observed for the compositions, containing algae and lignosilicon.

**Keywords:** *Fucus vesiculosus*, extracts, fertilizers, algal-lignin complex.



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## The Comparison of Pressed Seed Oils Features

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### Abstract

The grape seed oils are characteristic by a very high content of substances. However, a lipid oxidation is one of the most serious problems of the seed oils quality degradation. The important indicator for determining the specific type's purity, stability, and level of oil degradation might be its colour parameter. The aim of this study was to identify the different varieties of oils, to evaluate its development during storage and to identify changes in different pressed seed oils. The CIELAB method and NIR spectroscopy were used during the research. Its main advantages include speed, accuracy and simplicity. The use of NIR seemed to be unsuitable as it could not reliably identify different kinds of grape seed oils. There had been identified only three kinds of grape seed oils out of six. Contrary, the colour values obtained using the CIELAB correlated significantly with the maturity of the individual varieties. This method can help to verify the authenticity of the oil. CIELAB also enabled colour changes in storage. The results show that after six months of storage, the oil got browner and the  $L^*$  value had decreased. After another 6 months, the shift in values was not so significant. Similarly, the values of other parameters had changed. Using the CIELAB can be recommended for testing of larger sample sizes for future use in the evaluation of the authenticity and quality of seed oils. The CIELAB will not replace the standard methods but it might be used for pre-selection of tested samples.

**Keywords:** grape seed oils, CIELAB, NIR, oil degradation, colour parameter

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## Leaf Surface Area Estimation in Different Grapes Varieties Using a AM 300 Leaf Area Meter

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### Abstract

Experimental measurements during years 2014 and 2015 were focused on evaluation of grapevine leaf surface area development of nine varieties, in the viticultural conditions of South Moravia. The dynamics of leaf surface area development was measured by using a device called leaf area meter AM 300. The device operates on the principle of a scanner leaf area and the resulting values are expressed through the leaf area index - LAI. The measurements were carried out in five dates during phenophases of growth, flowering, initial development of fruits (berries pea-sized, berries beginning to touch) and ripening of berries and shoots. The results show significant differences in increase in leaf area between the evaluated varieties, especially during flowering. The size of the leaf area, depending on the focused year and corresponds to values between 7.615 and 13.483 square metres per hectare. The largest leaf area was reached in growth stage 8, which is ripening of fruit. The leaf area reached the largest size in the varieties Grüner Veltliner, Zweigelt, and Sauvignon, with values ranging from 20.560 to 26.481 square metres per

hectare. The results suggest that a significant proportion of leaf area is also represented by lateral shoots whose size in the ripening phase, depending on variety and ranges from 33.7 to 52.9 per cent of the total leaf area. These facts may in practice mean that for varieties with enough foliage, namely Müller Thurgau, Sauvignon Blanc, Grüner Veltliner, Blaufränkisch, St. Laurent, and Zweigelt, it is possible to incorporate the defoliation operation to the technological process to increase the quality of grapes. In the second group with less foliage, namely Chardonnay and Pinot Noir, in order to achieve the highest quality of grapes, rather a reduction of harvest can be recommended or to carry out defoliation or breaking off lateral shoots considering a thorough knowledge of local conditions.

**Keywords:** viticulture, grapevine, leaf, leaf area index, leaf area metre, lateral shoots

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## The Effect of Post-Harvest Treatment and Storage Conditions on Vitamin C Content in Leafy Parsley Two Cultivars

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### Abstract

The aim of the study was to determine the content of vitamin C in two leafy parsley (*Petroselinum crispum*) cultivars subjected to different post-harvest treatments. 'Rialto' has flat leaves and 'Petra' - triple-curved leaves. The plant material was obtained in 2015 and 2016 from SGGW experimental field. Two methods of storage were applied: 1) in the cold store and 2) in simulated retail conditions. In the case of cold storage, the leaves were washed: a) directly after harvest in tap water or b) in tap water with ozone added. The plants were tied in tufts and stored at the cold store at 0°C and RH 90% for 7, 14, 28 days: 1) in containers, where leaves petioles were immersed in water, and 2) in special bulk modified atmosphere packaging (MAP), dedicated to fresh herbs (Stepac, Israel). In the case of simulated retail conditions, the leaves were kept for 48 hours at 10°C, RH 30-40%, in two variants: 1) tufts wrapped in PE film with petioles immersed in water, 2) packed to retail MAPs, dedicated to herbs (Stepac, Israel). Concentration of L-ascorbic acid was determined spectrophotometrically, by reaction of Folin's reagent in low pH. Fresh and stored 'Rialto' leaves showed higher AA content than 'Petra' leaves (110 and 44 mg·g<sup>-1</sup>, respectively). Decrease of AA was observed during the storage. Average concentration of AA after 7 days was 85 and 44 mg·g<sup>-1</sup> for 'Rialto' and 'Petra', respectively. After 28 days the concentration was 54% lower for 'Rialto' and 36% lower for 'Petra'. Leaves after simulated retail conditions showed lower AA content than stored for 7 days in the cold room. Retail MAPs better preserved AA in parsley than immersing in water. Washing in ozonated water influenced only AA content in 'Rialto' leaves wrapped in film – they showed lower AA content. The content of AA was cultivar dependent. Ozone treatment did not have effect on AA during storage. Storage duration, rather than packaging methods, plays a key role in preservation of AA in the cold store. However, method of packaging is important in retail, when temperature is higher and RH is much lower.

**Keywords:** ascorbic acid, MAP, ozone, parsley, storage,

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## **Fatty Acid Composition in Buckwheat (*Fagopyrum esculentum* M.) Flours and Their Extruded Products**

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### **Abstract**

Lipids compose a small part of buckwheat seed, but they play an important role in the quality of food. The aim of this study was to evaluate the composition of fatty acids in different buckwheat flours (raw, roasted, white, black and germinated) and their extruded products. Fatty acids were quantified by gas chromatography according to the BIOR-T-012-131-2011 method. The prevalence of unsaturated fatty acid was determined which varied between 78.7 and 82.0 g 100 g<sup>-1</sup> of fat in buckwheat samples. Linoleic and oleic acids were the most abundant unsaturated fatty acids, whereas palmitic acid was the main saturated fatty acid in buckwheat flours and their extruded products. Unsaturated/saturated fatty acid ratio was determined within 3.69 and 4.56, whereas linoleic/ $\alpha$ -linolenic acids ratio was between 13.54 and 16.04. No trans-fatty acids in buckwheat flours and their extruded products were observed. The results showed that germination and extrusion of buckwheat flours didn't have any effect on the content and composition of fatty acids ( $p > 0.05$ ).

This research was supported by National Research Programme AgroBioRes (2014-2017) and the project “Strengthening Research Capacity in the Latvia University of Agriculture”.

**Keywords:** fatty acids, buckwheat, extrusion

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## **Influences of Biological Preparations on Soil Properties in the Spring Wheat Crop**

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### **Abstract**

The natural biochemical, biophysical and biological processes in the soil is changing due to the intensive use of pesticides. At present, it is actual fertilization technologies, which are based on non-fertilizer rates increase but on their rational use because in the fertilizer is unnecessary chemical compounds that promote mineral nutritional elements leaching. Have been studied the effect of biological preparations BactoMix, AgroMik and Rizobakterin on soil physical properties in spring wheat crop. Experiments were carried out in 2015–2016 at the Experimental Station of Aleksandras Stulginskis University on *Calcari-Endohypogleyic Luvisol*. The mean annual temperature of the study site is 6.0–6.5 °C, mean annual precipitation is 600–650 mm and mean annual length of sun shine is 1750–1800 hour (Lithuanian Hydrometeorological Service). Biological preparations sprayed on the soil surface and incorporated in the soil by sowing spring wheat. The use of biological preparations had a tendency to reduce soil density (from 2.3 to 5.3 %), to increase soil porosity (from 0.6 to 2.1 %). Biological preparations had no significant influence on quantity couples filled with moisture and air. The hardness of the soil after spring wheat harvest was the smallest in the fields sprayed by Rizobakterin preparation. The use of biological preparations BaktoMix and Rizobakterin significantly increased soil moisture. The following preparations significantly decreased soil pulverized fractions (micro structure) and significantly increased amount of particles larger than 10 mm.

**Keywords:** biological preparations, soil properties.

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## Weed Control Methods in Sugar Beet Cultivation

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### Abstract

The effect of non-chemical weed control on organically grown sugar beet crop weedness and productivity was investigated at the Experimental Station of the Aleksandras Stulginskis University in 2015-2016. The aim of the experiment was to establish the influence of living mulch, mechanical weed control methods (mellowing, cutting, mulching) and steaming on number and dry mass of weeds and sugar beet crop quality and productivity parameters. Treatments of the trial were: 1. hand weeding-cutting, (control treatment); 2. Interrow cutting; 3. Persian clover living mulch; 4. white mustard living mulch; 5. spring barley living mulch; 6. steaming. According to the results of investigations, hand weeding-cutting and steaming were the most effective weed control methods. In intensive soil tillage conditions the highest smothering of weeds was observed of persian clover and white mustard living mulch. Other weed control methods were suitable for organically grown sugar beet but not significantly effective.

Different weed control methods usually had no significant impact on the sugar beet crop density, but yields substantially decreased from 20 to 35 t ha<sup>-1</sup>. The effect on sugar beet root quality indices was mostly minor. However the highest amount of white sugar was observed in control variant (8.51 t ha<sup>-1</sup>) plots because of the biggest root yield.

**Keywords:** sugar beet, weed control methods, productivity, quality

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## Asparagus Decline in Crop Production and Autotoxicity

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### Abstract

Asparagus (*Asparagus officinalis* L.) is a perennial vegetable that is harvested over several years. One major problem of the asparagus cultivation is the “asparagus decline”. Crop production and quality of asparagus decrease gradually year by year. One of the possible reasons for “asparagus decline” is thought to be the infection by pathogenic fungi such as *Fusarium*. The autotoxicity of asparagus can also be a reason for “asparagus decline”, since the growth of asparagus is inhibited by asparagus root residues incorporated into the asparagus cultivation soils. This finding suggests that asparagus roots may contain some autotoxic compounds. However, the autotoxic property of asparagus rhizomes remains unknown. The objective of this study was to determine the potential role of rhizomes in the autotoxicity of asparagus. An aqueous methanol extract of asparagus rhizomes inhibited the growth of asparagus seedlings. These results suggest that asparagus rhizomes contain autotoxic compounds. The extract was purified through several



chromatographic steps with monitoring the autotoxic activity, and *p*-coumaric acid and iso-agatharesinol were isolated. These compounds inhibited the shoot and root growth of asparagus at concentrations higher than 0.1 mM. The concentrations required for 50% inhibition of the root and shoot growth of these test plants were 0.36 and 0.53 mM and 0.62 and 0.72 mM for *p*-coumaric acid and iso-agatharesinol, respectively. Therefore, these compounds may contribute to the autotoxicity caused by asparagus rhizomes and may be involved in “asparagus decline”.

**Keywords:** Allelopathy, *p*-Coumaric acid, Growth inhibition, Iso-agatharesinol, Phytotoxicity.

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## **Major Nutrient Elements and Micronutrient Stimulate Compositions in Cultivation Technology of Lucerne in Forest Soils of the Russian Middle Volga Forest-Steppe Zones**

**Faik Safiollin, Marsel Khismatullin, Svetlana V. Sochneva**

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### **Abstract**

In fodders production mineral fertilizers costs take from 25% to 30 % of total expenses and this is one of the main reasons of high price for meat and dairy products in retail sale. That is why in highly developed countries where there is a high productiveness of breeding animals and where the livestock products are competitive it is considered that usage of biological stimulating agents of growth and micro fertilizers and less expensive sources of main nutrition elements are thought prospective line of development crop growing and also fodder production.

Hence, in this scientific article it is described comparative evaluation of efficiency of 6 extra nutrition sources for perennial grasses in low fertile gray forest soils of Tatarstan Republic.

**Keywords:** Fertilizers: Rizogrin, Azotovit, Phosphatovit, IzagriFors, awnless brome, fescue grass, timothy grass, yield, crude protein, prime cost, profitability.

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## **Alternative Sources of Fertilizer Nutrition Elements of Perennial Grasses in Gray Forest Soils of Tatarstan Republic**


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### **Abstract**

In fodders production mineral fertilizers costs take from 25% to 30 % of total expenses and this is one of the main reasons of high price for meat and dairy products in retail sale. That is why in highly developed countries where there is a high productiveness of breeding animals and where the livestock products are competitive it is considered that usage of biological stimulating agents of growth and micro fertilizers and less expensive sources of main nutrition elements are thought prospective line of development crop growing and also fodder production.

Hence, in this scientific article it is described comparative evaluation of efficiency of 6 extra nutrition sources for perennial grasses in low fertile gray forest soils of Tatarstan Republic.

**Keywords:** Fertilizers: Rizogrin, Azotovit, Phosphatovit, IzagriFors, awnless brome, fescue grass, timothy grass, yield, crude protein, prime cost, profitability.



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## **Impact of Soil Tillage Intensity on Faba Bean Cultivation**

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### **Abstract:**

A long-term stationary field experiment (since 1988) was carried out at the Experimental Station of the Aleksandras Stulginskis University. Five different tillage patterns were investigated: 1) conventional (22–25 cm) ploughing by a mouldboard plough, 2) shallow (12–15 cm) ploughing by a mouldboard plough, 3) deep (25–30 cm) tillage by a chisel cultivator, 4) shallow (10–12 cm) tillage by a disc harrow, 5) no-till. The aim of research was to establish the impact of reduced environment-friendly tillage systems on faba bean biometric, productivity and quality parameters at the end of the vegetation. Data of 2016 are presented.

Research methods: crop germination and stand density (first test) was assessed in 10 sites by accounting method at the 3 and 10 days from the start of germination. Samples for biometric, productivity and quality parameters were set at the end of the growing season of faba beans by taking no less than 10 samples from 1 row. Samples were taken from 20 plots of experiment. We evaluated mean bean plant height (cm), the sample dry biomass, the average number of pods per plant or per sqr. m, beans grain yield, 1000 grain mass and etc. Amount of proteins in bean grains was established in the laboratories of Research Centre for Agriculture and Forestry. Results of the experiment were evaluated by the methods of variance and correlation analysis.

Research results showed, that different tillage systems usually had no significant effect on the faba bean crop biometric, productivity, energy and

qualitative parameters (plant height, number of pods per sq. m, 1000 grain weight, grain yield and protein content, energy equivalent and so on) at the time of faba bean crop harvest.

**Keywords:** faba bean, biometrics, productivity, quality.

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## Valorization of Preserved *Thymus Satureioides* Compounds: Polyphenol and Antioxidant Activity

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### Abstract

The various applications of *Thymus satureioides* make it with enormous importance in industrial scale and trade. This plant showed different effects among them antiseptic, antispasmodic, tonic, antibacterial and anti-inflammation. Hence, it is necessary to preserve it for marketing interest but also to analyze its compounds and their effect especially the phenolic content and the anti-oxydant activity. The purpose of our study is to insure the conservation of our plant by thermobiochemical process integrating solar energy. It is a non-destructive process for eco-conservation of trade *Thymus satureioides*. The influences of this preservation process on phenolic compounds were investigated and correlated to the antioxidant activity before and after treatment. The efficiency and benefit of this process have been demonstrated. Polyphenols content of treated thyme remain intact in comparison with the untreated thyme in term of quality. However, the process induces an increase in the total phenolic content quantity and affected by the way the antioxidant activity.

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**Keywords:** Thym, quality, preservation, polyphenol, antioxidant

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## **The Quality of Milk High Yield Holstein Breed Under Conditions of Elevated Daily Average Temperature**

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### **Abstract**

In a 7-page article, the results of studies on the quality of milk high yield Holstein breed under conditions of elevated daily average temperature.

Dairy cattle breeding of Stavropol region is considered to be one of the fastest growing branch of farming in North Caucasus district and is characterized by up-to-date production assets in both breed livestock and commercial farms. Dairy cattle breeding is represented by high-production bovine cattle of Black Pied and Red Pied Holstein, Ayrshire, Black Pied and Red Steppe breeds. The issue of choosing final genotype and suitable conformation features for commercial dairy herds under higher-than-average insolation in North Caucasus and keeping lactating cow at outdoor ground runs is still under discussion.

The research objective was to study quality of milk and ethological features of high-production bovine cattle of various color types under conditions of higher-than-average insolation in summertime while keeping it at outdoor ground runs. Research data was collected in the course of observations over a Black Pied Holstein dairy herd (80 head). The herd included the 1st group (40 heads) of mainly (up to 85%) light color and the 2nd group (40 heads) of pied type with dominant dark color.

The research results revealed that summer indices of feeding activity in lighter cows were 13.2% higher compared to dark color cows. That contributed to the increase in milk producing ability in cattle from the 1st group by 11.4% in comparison to the 2nd group, while in cattle milk to the 2<sup>nd</sup> group the content of milk fat decreased by 5.7%, and somatic cells increased by 53%. Thus, it is meaningful to choose seed bulls of dominant light color when selecting parental pairs under conditions of average insolation of 630-640 MJ/m<sup>2</sup>.

**Keywords:** quality of milk, dairy cattle breeding, Holstein

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## ***Festulolium* Metabolites Accumulation Response to Photoperiod of Flowering Termination**

**Jolanta Leliūnienė, Ligita Baležentienė, Evaldas Klimas**

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### **Abstract**

Most of plant development, physiological and metabolic processes are regulated by not only soluble sugars such as glucose and sucrose, but also by other signal molecules, such as phytohormones.

The investigation of flowering induction, considering the influence of vernalisation duration and photoperiod on morphogenesis stages and accumulation metabolites in two *Festulolium* cultivars 'Vėtra' and 'Punia' was carried out at the phytotron complex of the Plant Physiology Laboratory, Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry in 2011-2012.

The data revealed impact of vernalisation and photoperiod on accumulation of both types of assessed metabolites, i.e. phytohormones and saccharides, and thus confirmed their substantial role. 90 short-day vernalisation induced the highest total phytohormone content in 'Vėtra', when plant achieved tillering stage and was going for intensive growth when growth regulators will be important in the metabolic regulation.

The highest phytohormone content was recorded after long –day 130+20 day vernalization at VII and IV organogenesis stages of 'Vėtra' and 'Punia' respectively.

Saccharides content significantly depended on photoperiod and temperature during vernalisation and was different in 'Vėtra' and 'Punia'.

**Keywords:** *Festulolium*, phytohormones, saccharides.

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## Vernalisation impact on biometrical parameters of new *Festulolium* varieties

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### Abstract

Many plants, including *Festulolium*, grown in temperate climates require vernalization and must experience a period of low winter temperature to initiate or accelerate the flowering process. The aim of research was to investigate impact of vernalisation thermoinduction on growth and development parameters of *Festulolium* two varieties 'Vėtra' and 'Punia'.

Investigations were carried out in Lithuanian Research Centre for Agriculture and Forestry Institute of Horticulture, Plant Physiology Laboratory of phytotron complex in 2011-2012. The aim of research is to investigate some peculiarities of growth and development of *Festulolium*. *Festulolium* varieties 'Vėtra' and 'Punia' were investigated. 5 plants were sown in each 5 liter pot in neutral peat substrate (pH 6-6.5). The plants were grown in greenhouse till the tillering phase at the temperature of  $20\pm 2^{\circ}\text{C}$  at daytime and  $16\pm 2^{\circ}\text{C}$  at night. Later plants were moved to low temperature chambers for 90, 110 and 130 days for passing of vernalisation processes, where the 8 and 16 hour photoperiod were maintained at  $4^{\circ}\text{C}$  temperature. After vernalisation periods plants were removed to a greenhouse for additional 20 days. Biometric parameters, namely plant height, shoot number, and dry mass were measured after each period in greenhouse and climatic chambers.

The data revealed different response of *Festulolium* new varieties 'Vėtra' and 'Punia' to vernalisation conditions. According to our data 'Vėtra' plant height



was 6% higher than the 'Punia' after 130+20 days of vernalisation. Nonetheless, vernalisation temperature conditions have no significant impact on shoot number. 110 and 130 long-day photoperiod significantly impacted on shoot number of *Festulolium* 'Vëtra'. Otherwise, 90 days vernalisation of both photoperiod induced significantly the highest length of 'Punia' shoots. 'Vëtra' accumulated significantly the maximum dry matter after 110 days vernalisation period, than that after 90 and 130 days.

**Keywords:** *Festulolium*, vernalisation, photoperiod, morphometry

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## The Determination of Oleic Acid Contents in Sunflower Hybrids

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### Abstract

High oleic sunflower is new trend both in Turkey and also in the world due to that it present healthy vegetable oil and also higher standing ability for frying. Higher oleic acid also affects from environment especially high temperatures during the grain filling period but genetic contribution is also important. High oleic acid content comes from Pervenent mutation in sunflower and it controlling Ol genes. However, because of being a seed trait which is determining after harvest, it is so difficult and unnecessary works (waiting even low oleic ones until seed threshing, etc) to select high oleic sunflower genetic materials. Therefore, selection utilization of molecular markers for determining

of higher oleic types help breeders a lot to select accurately high oleic ones and also reduce costs both workers, isolation material, etc. The study covers determining of higher oleic type sunflower genetic materials developed in National Sunflower Hybrid Breeding Project conducted by Trakya Agricultural Research Institute. To screen of high oleic acid genotypes, around 400 sunflower F2 and F3 individuals obtained from crosses between high oleic acid and low oleic acid lines were used in TUBITAK (The Scientific and Technological Research Council of Turkey) Project 1001- 114O971. Fatty acids of sunflower genotypes were determined by Agilent 6850 Gas Chromatography in Trakya University Lab. Based on the study results, oleic acid contents of sunflower genotypes were changed between 21,9-91,8%, linoleic acid contents of them between 1,1-66,5%, palmitic acid contents of them were between 3,4-8,0% and stearic acid contents of genotypes were changed between 1,1-9,7%. The higher oleic types were selected based on the study results for further generations.

**Keywords:** Sunflower, Oleic Acid, Quality, Hybrid Breeding

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## The Milk Quality Indicators of Dynamics Throughout The Day

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### Abstract

In a 7-page article, the results of studies on the organization of work on the management of a herd of dairy cows, taking into account the methodology of ICAR, show the interaction of the control-assistant service and the laboratory for assessing the quality of milk. The results of studies of milk quality indicators in dynamics throughout the day are presented.

The Ayrshire breed is imported for the North Caucasus, but due to its endurance and unpretentiousness to fodder, these animals in the twentieth century have received sufficient distribution in the southern regions of Russia. The average productivity of Ayrshire cows in the Stavropol region is about 6 thousand kg of milk per year, the fat content is 3.97%. The live weight is 507 kg. In pedigree farms these indicators are: milk - 6200 kg, fat - 3.82%, protein - 3, live weight - 534 kg. Breeding work with this breed is aimed at the development of dairy productivity and obtaining animals with satisfactory meat qualities.

A study of the daily dynamics of the fat and protein parameters is carried out at the Laboratory for Milk Quality Selection at the Stavropol State Agrarian University.

On the example of milk cows of Ayrshire breed the dynamics of diurnal parameters of fat and protein at 2 and 3 times milking of cows was established, which is non-linear and more accurately described by a polynomial function. For fat dynamics, the equation has the form:  $y = -0.0179x^2 + 0.46664x + 1$ , and for protein dynamics:  $y = -0.035x^2 + 0.195x + 2.84$ , where «y» is the protein concentration in milk (g,%), «x» is the concentration of fat in milk (g, %).

**Conclusions:** The study of the daily dynamics of milk quality indicators makes it possible to more accurately determine the daily requirements of dairy cows in nutrients and energy and to adjust the diets of their feeding.

**Keywords:** milk cows, milk quality, Ayrshire cattle

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## Features of the Karyotype of North Caucasus Ayrshire Dairy Cattle Population: Defects in Reproductive Functions

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### **Abstract**

In a 12-page article, the results of studies on the features of the Karyotype of North Caucasus Ayrshire Dairy Cattle Population. One of the ways of improving the genotypes of dairy cattle in Russia is to increase the proportion of the Ayrshire breed, which can be justly claimed to be one of the best dairy breeds in the world. However, due to the prevalence of large-scale breeding technologies, which involves the use of a limited contingent of dairy cattle bulls, including but not limited to the Ayrshire breed, the emergence of new-born calves with various anomalies, including chromosomal, which commonly have a hereditary basis attributable to gene mutations have been observed. Given that the bulk of these anomalies are acquired by recessive inheritance, they may not always manifest themselves in the phenotype and thus represent a hidden genetic load. In recent years, the significance of cytogenetic analysis and karyotyping is becoming increasingly important, not only when considering the theoretical assumptions, but also when solving applied problems aimed at preventing damage to agricultural production. This article presents the results of the cytogenetic analysis of Ayrshire cattle affected by reproductive problems. The following has been established: an absence of changes in the diploid set of the investigated dairy cattle ( $2n = 60$ ); the presence of aberrant cells, whose frequency of occurrence amounted to 3.6% in the population of 440 head (number of aberrations per aberrant cell researched –  $0.036 / 1.0$ ); the absence of reciprocal translocations in the karyotype of the investigated population. It is suggested that the existing Ayrshire sires Hannulan Yaskiyri, Riihiviidan Urho Errant, O.R.Lihting and their descendants do not have a genetic load of chromosomal abnormalities.

### **Conclusions:**

1. Changes in the diploid set of investigated cows of the North Caucasian Ayrshire population were not established ( $2n = 60$ ).
2. Since the frequency of occurrence of aberrant cells, consisting of 3.6% in the population of 440 head, is not high, the abnormalities found in the chromosomal complement of cows are likely to be due to chance rather than

heredity.

3. The existing Ayrshire sires Hannulan Yaskiyri, Riihiviidan Urho Errant, O.R.Lihting and their descendants used in the selection do not have a genetic load of ancestral chromosomal mutations.

**Keywords:** chromosome, karyotype, mutation, Ayrshire cattle

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## **Screening of Complex Vertebral Malformation (CVM) and Bovine Leukocyte Adhesion Deficiency (BLAD) in the Ayrshire Cattle Breed in the North Caucasus**

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### **Abstract**

In a 12-page article, the results of studies on the screening of complex vertebral malformation (CVM) and bovine leukocyte adhesion deficiency (BLAD) in the Ayrshire cattle breed.

The Ayrshire dairy breed is renowned for producing large quantities of high quality milk and, therefore, is frequently used for crossbreeding. However, various hereditary anomalies caused by gene mutations have been recently recorded in calves produced by some Ayrshire sires. Most of these anomalies were shown to have a recessive inheritance pattern, thus imposing a threat of unpredictable dramatic changes in cattle genotypes under such factors as genetic drift, selection and inbreeding. The purpose of this study was to examine the susceptibility of the Ayrshire cattle bred in the North Caucasus to such hereditary abnormalities as complex vertebral malformation (CVM) and bovine leukocyte adhesion deficiency (BLAD). The investigation was carried out on 16 cows with various phenotype and reproduction disorders that were selected based on a three-year veterinary observation of 440 livestock animals. The target group cows were generally the descendants of Hannulan Yaskiyri, Riihiviidan Urho Errant and O.R. Lihting. The results demonstrated that no

animals under study were the carriers of these genetic disorders, which proved the mutant alleles of BLAD and CVM to be absent from the Ayrshire cattle livestock bred in the North Caucasus. Therefore, the sires of these cattle can be successfully used for breeding.

**Conclusions:**

1. The DNA diagnostics carried out on the studied animals of the Ayrshire cattle bred in the North Caucasus has detected no carriers of the following recessive mutations: bovine leukocyte adhesion deficiency (BLAD) occurring in the CD-18 gene in locus 2244 and complex vertebral malformation (CVM) occurring in the 17<sup>th</sup> genetic linkage group in locus 2068.

2. It can, therefore, be suggested that the sires Hannulan Yaskiyri, Riihiviidan, Urho Errant and O.R.Lihting, used to breed the North Caucasus livestock, did not carry the abovementioned defective genes. The phenotype and reproduction disorders exhibited by the studied animals were likely to be of a non-hereditary nature.

**Keywords:** complex vertebral malformation (CVM); bovine leukocyte adhesion deficiency (BLAD); Ayrshire cattle breed

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## **An Investigation of Multilayer Perceptron Algorithm Employed for Estimation of Weight of Apple**

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**Abstract**

In agriculture, especially in fruit production, goods whose size, colour or weight are assorted, is undesirable. To obtain a unique product line, it is important to classify products with similar properties. The considered product in this study is the apple that is widely grown in Karaman province. Three types of apples has been used in this study called Golden Delicious, Granny Smith and Starking

Delicious. Totally 75 apples that divided into three group with equal quantities has been studied. During image capturing of the apples, DFK 23U445 USB 3.0 (with Fujinon C Mount Lens) industrial camera has been used. Image processing techniques were applied by using MATLAB software. For capturing apple images a closed area which have own lighting system was created. Images were taken by using a GUI developed on MATLAB. The diameter of the apple was obtained by using image processing algorithms. The volume of the apple was estimated by using diameter, area and fullness. The weight estimation of the apple was done by using Multilayer Perceptron algorithm. For various number of neurons in the hidden layer, the training have been done. The error rates were obtained for each of the neuron number in the hidden layer. Success rates were determined by comparing estimated weights of apples and their actual weight. As the result of the study the MAE and RMSE rate was obtained as 6.2543 and 7.5478 respectively.

**Keywords:** Image processing, Multilayer perceptron, Weight estimation.

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## **Effect of the Nitrogen and Magnesium Fertilisation on Yield and Economic Efficiency of Winter Triticale Production**

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### **Abstract**

The present investigations were undertaken, in which the winter triticale cultivar Twingo was examined, with the aim of analyzing production output, expressed by grain yield and its structure, as affected by different levels of nitrogen and magnesium fertilisation and assess and compare the economic efficiency of production technologies. This research encompassed the results of

a three-year (2013-2015) field experiment conducted at the Research Station in Tomaszkowo near Olsztyn, Poland. The experiment was set up in a random, split-plot design, with four replications. The first order factor was nitrogen fertilisation ( $\text{kg}\cdot\text{ha}^{-1}$ ): 30, 60, 90, 120 and 150. The second order factor was the level of magnesium fertilisation ( $\text{kg}\cdot\text{ha}^{-1}$ ): 0 and 5  $\text{kg MgSO}_4\cdot 7\text{H}_2\text{O}$ . Statistical analysis of the results showed that the grain yield was significantly affected by the year of the trial, nitrogen and magnesium fertilisation, interaction of the first and second factors was not proven. The method based on the standard gross margin (SGM) was used for the economic evaluation of the three production technology differentiated costs level. Technologies with the highest, middle and the lowest average yields were selected for comparisons. The compared technologies differed from each other in the rate of nitrogen and magnesium fertilization. The more intensive winter triticale technology in field trial, the greater the financial values of winter triticale yield as well as direct costs and direct surplus. The direct costs analysis references to the positive verification of the research hypothesis. The increase of the direct surplus value, which accounted 18.7%, was recorded when the intensity of cultivation increased. Increasing inputs for winter triticale production up to the level of intensive technology in trial conditions was economically justifiable.

**Keywords:** triticosecale, grain yield, yield components, nitrogen and magnesium fertilization, technology level

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## The Influence of Bioorganic Preparations on the Productivity of Conventionally Grown Winter Rape Activating and Saving the Use of Synthetic Chemicals

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### Abstract

The aim was to determine the impact of Raskila bio-organic preparation on the productivity of winter rape '*Sunday*' grown under conventional system, in order to activate and save the use of coating Rovral aqua flo and to improve the wintering of plants.

The scientific article presents the data of the conventional winter rape '*Sunday*' growth intensity, plant formation, accumulation of dry matter, seed quality parameters, fertility data and the influence of the use of bioorganic fertilizers e. winter rape '*Sunday*' seeds were coated with bioorganic preparations and synthetic coatings, and additionally sprayed with a bioorganic fertilizer solution. Agrotechnics was carried out according to the technology of winter rape growing at Aleksandras Stulginskis University Experimental station. Additional coating of winter rape seeds and additional spraying with bioorganic fertilizers had a positive influence on the processes of growth and development of winter rape. By combining seed treatments and coating with bio-organic Raskila fertilizers (3 l for 100 kg) and spray in autumn (3,0 l ha<sup>-1</sup>), the best results are achieved: the maximum rape seed yield was 3.87 t ha<sup>-1</sup> and the best quality production. Bioorganic fertilizers and coating Rovral aqua flo has statistically significantly increased the following indicators of winter rape Sunday: the length of the plant (118.16-127.64 cm), the number of branches (6-10), seeds in the silique (28.27), the seed yield (3.16-3.87 t ha<sup>-1</sup>). The highest seed yield was 3.87 t ha<sup>-1</sup>, applying Nagro preparations in the autumn and the Rovral aqua flo coating and spraying Raskila plants when the rape reaches a height of 5-7 cm (BBCH 10-19). Premium yield was 86.6 percent compared to control. Raskila fertilizers and coating Rovral aqua flo statistically significantly increased the following parameters of winter rape seeds: content of fat (41,52-43,05%), proteins (20,39-20,91%), glucosinolates decreased from 18,68 to 18,31 m mol g<sup>-1</sup>. This has improved seed quality. Treatment with Raskila and coating Rovral aqua flo decreased seeds and seedlings infestation and morbidity

due to *Fusarium*, *Drechlera*, *Alternaria*, *Penicillium*. Rates of coating can be reduced if combined with bioorganic fertilizers. Application of bioorganic fertilizers and coating in combination increases the effectiveness of coating. Bio-organic fertilizer reduces plant stress caused by synthetic coating.

**Keywords:** winter rape, bio-organic fertilizers, synthetic coating, biometric parameters, seed yield, efficiency.

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## Relation Between Apple-Tree Yield Self-Regulation and Meteorological Conditions During Fruit Set

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### Abstract

Apple-trees tend to bear huge amount of flowers or inflorescences. Plants have ability to eliminate excess number of fruitlets. Frequently fruit trees eliminate insufficient number of fruitlets to grow good quality fruits. Most processes related with yield self-regulation varies significantly between different apples-tree varieties. Also meteorological conditions had influence for flower buds differentiation and fruit growth during blooming and other development stages. The investigations were carried out in 2015 – 2016 at the institute of Horticulture. The main aim was to evaluate yield self-regulation singularity of various apple tree varieties in different meteorological conditions. In our experiment we made fruit self – thinning evaluation of 22 different varieties. After each fruit-drop period the number of developed and undeveloped seeds

were counted of self-sheded and normally growed fruits. Meteorological conditions during experiment were varying. In 2015 there were lack of rainfall. 2016 years were rainy. In different years fruit-trees formed similar amount of flowers. After blooming flowers that had not been pollinated were eliminated. From 22 varieties 16 of them set less fruits by 35 %. This could be determinate by low insects-pollinators activity due to rainy weather during blooming period. The analysis of self-sheded and picked fruits revealed essential bigger amount of developed seeds of self-sheded fruits in 2015 when fruit-set conditions were favorable. The reverse tendency were observed for picked fruits. In 2016 more undeveloped seeds were detected than in 2015. Under favorable conditions, fruit trees produce more fruits than they can produce, and therefore, in later stages of development, eliminate excess fruit with lower seed content. Meanwhile, in unfavorable fruit-set years, when there are lack of fruits, fruit trees grow those fruits that have low amount of normally developing seeds. Due to self-regulation mechanism in 2016, when conditions were unfavorable, 7% of fruits developed. In 2015 when conditions were favorable, fruit-set percent was 9,4%.

**Keywords:** Apple-tree; yield self-regulation, meteorological conditions; seeds; flowers

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## The Influence of Bioorganic Preparations on the Productivity of Conventionally Grown Winter Wheat Activating and Saving the Use of Synthetic Chemicals

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### Abstract

The influence of Raskila bioorganic preparations on the productivity of conventional winter wheat '*Olivin*', was investigated in order to stimulate and save synthetic herbicide Arrat and fungicide Tango Super for spring spraying. Scheme of research: 1. Control; 2. Winter wheat sprayed (BBCH 20-29) with Arrat 0.2 kg ha<sup>-1</sup>+Tango super 1.5 l ha<sup>-1</sup>; 3. Winter wheat sprayed (BBCH 20-29) with Arrat 0.2 kg ha<sup>-1</sup>+Tango super 1.5 l ha<sup>-1</sup>+Raskila 3.0 l ha<sup>-1</sup>; 4. Winter wheat sprayed (BBCH 20-29) with Arrat 0.1 kg ha<sup>-1</sup>+Tango super 0.75 l ha<sup>-1</sup>+Raskila 3.0 l ha<sup>-1</sup>. The best result in the period of 2014-2016 was received after application of the following combination in spring: Arrat + Tango super+Raskila. This combination allows to reduce the rate of pesticides in half (50%), the differences compared to control are significant, statistically reliable. A statistically significant increase in the following winter wheat '*Olivin*' quality parameters was found: protein 13.1-14.8%, gluten 24.3-29.7%, number of falls 228-292 s, starch 65.7-70.0%. Application of Raskila fertilizers has raised the grain quality class. The best results were in variants 3 and 4, where the I class of grain quality was achieved. Combination of Raskila fertilisers and pesticides: herbicide Arrat and fungicide Tango super statistically significantly increased the following winter wheat '*Olivin*' characteristics - plant length 101,22-104,23 cm, penis length 6,86-7,14 cm, grains in ear 28,96- 30.02, grain yield 6.71-7.03 t ha<sup>-1</sup>. Application of Raskila fertilizer 1.0 l ha<sup>-1</sup> and herbicide Arrat 0.1 kg ha<sup>-1</sup> decreased the number of weeds from 62.5 to 57.6 units per m<sup>2</sup> and the weed weight decreased from 41.30 to 33.70 g m<sup>2</sup>. Stronger wheat crop overshadowed weeds better. Combination of Raskila and Tango super reduced the prevalence and severity of diseases in winter wheat such as *Septoria spp.*, *Pyrenophora tritici-repentis*, *Erysiphe graminis*, powdery rust (*Puccinia recondita*).

**Keywords:** winter wheat '*Olivin*', organic fertilizers Raskila, herbicide Arrat, fungicide Tango super, grain yield, efficiency.

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## **Integration of Fish, Poultry and Rice: the Silent Revolution Towards Improving Food Security in West and Central Africa**

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### **Abstract**

Integrated fish farming system is one of the key production systems that have shown great potentials of meeting self-sufficiency in food security in West and Central Africa. “Sustainable Integrated pond based aquaculture with rice and poultry production: Economic, social and Environmental Assessment” is a competitive project financed by Multi Donor Trust Fund (MDTF) coordinated by West and Central African Council for Agricultural Research and Development (CORAF/WECARD) with the World Bank as disbursing agency. The project involve integration of fish with poultry and rice, using a new holistic and participatory methodologies referred to as the integrated Agricultural Research for Development (IAR4D). This study was carried out in Nigeria (South West, North Central and South East), Cameroun and Sierra Leone. The study has raised the state of knowledge in the practice of integrated fish farming and identifies opportunities of ensuring sustainable income and productivity from this system. The comparative study of conventional fish farming systems (intensive and semi-intensive) with integration of fish, rice and poultry farming

system revealed that integrated fish farming is more profitable than unitary system of farming as it ensures a spread of financial risk for its varied and diversified nature in rearing of fish, animals and crops. Food Conversion Ratio and Specific Growth Rate of  $1.90 \pm 0.18$ ;  $3.96 \pm 1.02$  (convectional system) and  $1.25 \pm 0.22$ ;  $3.16 \pm 0.29$  (IAS) were recorded respectively. The total yield of rice harvested after 12 weeks in the paddy area of the pond in IAS was 3.3t/ha while between 1.63t/ha and 2.3t/ha was recorded in conventional system of rice production. Mean egg production of  $52 \pm 1.50$  eggs per day and  $53 \pm 1.0$  eggs per day were obtained in IAS and convectional system respectively

It has been established from the efforts of this project that integrated fish, rice and poultry production is practicable, environmental friendly and profitable. With proper operational mechanisms in place, it can serve as a major tool of ensuring food security and enhance livelihoods in West and Central Africa. How to tackle several barriers that can impede sustainable growth of this system were also highlighted.

**Keywords:** Integration, food security, livelihoods, sustainability, West and Central Africa

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## **Effect of Exogenous Amino Acids on Osmolytes Accumulation in Winter Rapeseed During Autumn Period**

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### **Abstract**

Freezing temperatures is the main environmental factor limiting the productivity of many agricultural plants. During the evolution process, most plants have been acquired mechanisms by which they can increase their freezing tolerance during cold acclimation. During period of low non-freezing temperatures in the plants occur changes at physiological, biochemical and

molecular levels. During cold acclimation in leaf cells of the plants increased the content of most solutes and according several research reports at last some of these solutes may be important for the increasing of plant cold tolerance. Accumulation of soluble carbohydrates during cold acclimation is very well documented. Researchers supposed that they play an important role in the development of plant cold tolerance. On the other hand, several research groups reported that there are positive correlation between cold tolerance and endogenous proline content in the plant tissues. The experiments were carried out in 2014–2016 at the Experimental Station of Aleksandras Stulginskis University with winter rapeseed cultivar ‘Cult’. The effect of environmental temperature during autumn period and exogenous applied amino acids (L-proline and L-glutamic acid) on osmolytes (soluble sugars and endogenous proline) content in winter rapeseed plants during cold acclimation has been investigated. The analysis of variance revealed that environmental temperature, tested exogenous amino acids and their interaction significantly influenced osmolytes accumulation in winter rapeseed plants during autumn period.

**Keywords:** Winter Rapeseed, Amino Acids, Osmolytes

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## Comparison of the Quality of Different Spear Segments of *Asparagus (Asparagus officinalis L.)* Reared in Lithuania

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### Abstract

*Asparagus (Asparagus officinalis L.)* is a plant grown all over the world. It is a valuable, nutritious vegetable delicacy. More than 90% of water, 1.9% of proteins, 2.04% of carbohydrates, 1.31% of fibre, 0.16% of fat are detected in asparagus spears. These vegetables contain 1.3 mg of carotene, 0.14 to 0.19 mg of B vitamins, and 40 mg of vitamin C. According to scientists, more mineral substances are cumulated in the upper part of the spears comparing with other parts of the vegetable. The aim of the study is to compare the quality of different parts of fresh asparagus spears.

The studies on the quality of different parts of asparagus spears were carried out in 2015-2016 at the Institute of Agricultural and Food Sciences at Aleksandras Stulginskis University. Spears of two asparagus varieties ‚Avalim‘ and ‚Gijnlim‘ were explored. Spears of 15 cm in length and 1 cm in diameter were selected and divided into three segments of 5 cm in length, i.e. spears were divided into three parts - upper, middle and lower. Chemical composition of fresh parts of asparagus spears (dry matter, vitamin C, potassium, nitrate, protein and fibre contents) was determined in the Laboratory of the Quality of Plant Raw Materials at Aleksandras Stulginskis University applying standardized analysis methods. Hardness and crispness of spears was tested by texture analyser TA.XT Plus, Stable Micro Systems (UK). Probe of 0.79 mm diameter with a pointed tip was used for spears piercing. Data of the research were statistically processed using STAT program from the statistical analysis package ‚SELEKCIJA‘. Arithmetic means and standard deviations of the data were calculated.

The studies showed that the highest contents of vitamin C, dry matter, potassium and protein and the lowest nitrate content were determined in the upper part of asparagus spears. The largest content of fibre was found in the lower part of asparagus spears. The maximal hardness and elasticity were defined in the lower part of the spears as well.



**Keywords:** asparagus (*Asparagus officinalis* L.), spear segments, spears chemical composition, spear strength, spear hardness.

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## **Main Directions of Development of Spring Wheat Production Agricultural Technologies for Sustainable Arable Farming in the Forest-steppe Belt of the Middle Volga Region**

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### **Abstract**

The article presents results of studies of influence of controlled and environmental factors on production process of different varieties of spring wheat carried out in different soil and climatic conditions of Middle Volga region.

The forest-steppe area of the Volga region is one of regions of Russia favorable for spring wheat growing by its natural and climatic conditions. Unbalance of nutrition elements in soil, acid soil and predominantly heavy-textured soil hamper the yield growth. Out of all factors vital for plants (light, heat, moisture and nutrition elements) under consideration, providing plants with nutrition elements and moisture are those limiting high crop yields.

Having carried out the analysis of natural resources and genetic potential of the wheat varieties, systems of plant nutrition optimization and influence of their

predecessors, we have obtained new data about possibility of increasing the spring durum wheat arable area. We have shown the role of different forms of using nitrogenous fertilizers (on the background of phosphorus – potassium ones) in the increase of productivity and improvement of the spring wheat grain quality. An established optimal norm for Gramma variety spring spelt corn seeding has been established for the conditions of the grey forest soil in the Fore-Kama region of the Republic of Tatarstan and the influence of their nutrition on yield has been found.

**Keywords:** seeding rate, predecessors, spelt corn, varieties, fertilizers, crop yield, Trans-Kama spring wheat

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## **Integration of fish, poultry and rice: the silent revolution towards improving food security in West and Central Africa**

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### **Abstract**

Integrated fish farming system is one of the key production systems that have shown great potentials of meeting self-sufficiency in food security in West and Central Africa. “Sustainable Integrated pond based aquaculture with rice and poultry production: Economic, social and Environmental Assessment” is a competitive project financed by Multi Donor Trust Fund (MDTF) coordinated by West and Central African Council for Agricultural Research and Development (CORAF/WECARD) with the World Bank as disbursing agency. The project involve integration of fish with poultry and rice, using a new holistic and participatory methodologies referred to as the integrated Agricultural Research for Development (IAR4D). This study was carried out in Nigeria (South West, North Central and South East), Cameroun and Sierra Leone. The study has raised the state of knowledge in the practice of integrated fish farming and identifies opportunities of ensuring sustainable income and productivity from this system. The comparative study of conventional fish farming systems

(intensive and semi-intensive) with integration of fish, rice and poultry farming system revealed that integrated fish farming is more profitable than unitary system of farming as it ensures a spread of financial risk for its varied and diversified nature in rearing of fish, animals and crops. Food Conversion Ratio and Specific Growth Rate of  $1.90 \pm 0.18$ ;  $3.96 \pm 1.02$  (convectional system) and  $1.25 \pm 0.22$ ;  $3.16 \pm 0.29$  (IAS) were recorded respectively. The total yield of rice harvested after 12 weeks in the paddy area of the pond in IAS was 3.3t/ha while between 1.63t/ha and 2.3t/ha was recorded in conventional system of rice production. Mean egg production of  $52 \pm 1.50$  eggs per day and  $53 \pm 1.0$  eggs per day were obtained in IAS and convectional system respectively

It has been established from the efforts of this project that integrated fish, rice and poultry production is practicable, environmental friendly and profitable. With proper operational mechanisms in place, it can serve as a major tool of ensuring food security and enhance livelihoods in West and Central Africa. How to tackle several barriers that can impede sustainable growth of this system were also highlighted.

**Keywords:** Integration, food security, livelihoods, sustainability, West and Central Africa

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## **Extension of Weibull Model for Describing of Dried Apple Rehydration**

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### **Abstract**

Sample of Ligol variety apples (slices of 3 and 10 mm thickness and cubes of 10 mm thickness) were dried using following methods: natural convection (drying air velocity amounted to 0.01 m/s), forced convection (0.5 and 2 m/s), fluidized bed drying (6 m/s). The drying air temperature was kept at 50, 60, and 70°C. The dried apples samples were rehydrated in distilled water at 20, 45, 70,

and 95°C. The Weibull model given for describing time dependence of the moisture content change was fitted to experimental data and model parameters were determined by multiple regression analysis. The variation of model parameters with characteristic particle dimension ( $L$ ), drying air velocity ( $v$ ), drying air temperature ( $t_d$ ), and rehydration temperature ( $t_r$ ) described as multiplication type. By using these verification of parameters, extended Weibull model for describing combine effects of  $L$ ,  $v$ ,  $t_d$ ,  $t_r$ , and drying time was derived and the parameters of the model were also determined by multiple regression analysis. The accuracies of both models were measured using the determination coefficient ( $R^2$ ), mean bias error (MBE), root mean square error (RMSE), reduced chi-square ( $\chi^2$ ), and t-statistic method. The Weibull model ( $R^2=0.8319-0.9957$ ,  $MBE=-0.0044-0.0110$ ,  $RMSE=0.0189-0.1248$ ,  $\chi^2=0.0004-0.0180$ , and  $t\text{-stat}=0.0149-0.2875$ ) and the extended Weibull model ( $R^2=0.9130-0.9948$ ,  $MBE=-0.0209-0.0377$ ,  $RMSE=0.0230-0.0719$ ,  $\chi^2=0.0007-0.0057$ , and  $t\text{-stat}=0.0389-1.2214$ ) described the rehydration characteristics of dried apple satisfactorily. The extended model by taking into account the effect of  $L$ ,  $v$ ,  $t_d$ , and  $t_r$  on its parameters can be considered as more general one.

**Key words:** apple, rehydration, Weibull model.

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## The Effect of Homo - and Hetero - Fermentative Lactic Acid Bacteria Mix on the Ensiled Lucerne Fermentation Characteristics and Aerobic Stability in Big Bales

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### Abstract

The aim of this study was to determine the effect of homo- and hetero-fermentative lactic acid bacteria mix on the ensiled lucerne fermentation characteristics and aerobic stability in big bales. The lucerne was ensiled without additives (C) and treated with a mix of bacterial inoculant that contains *Lactococcus lactis* and *Lactobacillus buchneri* (50:50) (I). Silage was treated with bacterial inoculant, which significantly increased the total organic acids concentration by 69%, lactic acid by 92% and acetic acid by 76%. If the results were compared with the C silage, the inoculation significantly decreased the concentrations of butyric acid by 73%, ethanol by 53% and ammonia - N concentration by 33%. Inoculated silage had significantly lowered the yeast count by 59% and moulds count by 34%. Compared to the inoculated silage and during the aerobic exposure, the untreated silage maximum temperature was significantly higher (13.9 °C vs 4.6 °C) ( $P < 0.05$ ). Therefore, the bacterial inoculant improved the quality of fermentation and aerobic stability in lucerne silages.

**Keywords:** aerobic stability, lactic acid bacteria, lucerne, silage.

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## Integrated Assessment of Organic Spring Rapeseed Crop Applying non-chemical Weed Control in Combination With Bio-preparations

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### Abstract

Increasing environmental awareness, demand for safe, organic food and concerns about decreasing soil fertility, rapeseed cultivation in an organic farming might be a relevant solution contributing to environment protection and climate change mitigation. Therefore in 2014–2016 carried out field experiments of organic spring rapeseed (*Brassica napus* L. spp. *oleifera annua* Metzg.) at the Experimental Station of Aleksandras Stulginskis University which is in the Kaunas District (54°53' N, 23°50' E), Lithuania. The aim of the research was to estimate the effects of non-chemical weed control methods (thermal, mechanical and self-regulation) and bio-preparations on the of spring rapeseed crop.

Experimental results of integrated assessment of organic spring rapeseed crop, which involves soil enzyme activity, earthworm and weed mass, the most prevalent diseases and pests, and CO<sub>2</sub> emission from the soil, showed that in the treatments of spring rapeseed grown with and without bio-preparations, irrespective of the non-chemical weed control methods applied, the rapeseed yield assessment points did not rise above the assessment limit, i.e., five points. Analysis of soil enzyme activity in crop without bio-preparations showed, that for the thermal weed control treatment the assessment point of saccharase activity was higher than the assessment limit. Without the use of biopreparations, when using self-regulation, the assessment point of urease activity was close to five points and when using bio-preparations, the assessment point of urease activity was significantly higher than five points. The highest assessment points of earthworm and weed dry mass, and CO<sub>2</sub> emission from the soil, both with and without the use of bio-preparations were established when using self-regulation. The effect of the non-chemical weed control methods against the most prevalent diseases and pests occurring in the spring rapeseed crop, i.e., flea beetle and dark leaf and pod spot, was positive,

as the assessment points of the latter indicators were higher than the assessment limit in most cases.

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**Keywords:** soil enzyme activity, earthworms, CO<sub>2</sub> emission, weeds, diseases, pests.

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## Effectiveness of supplementary mineral fertilization of organically grown winter spelt with K and Mg

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### Abstract

Two series of field experiments on supplementary mineral fertilization of winter spelt wheat (*Triticum spelta* L.) were carried out. Mineral fertilization was applied in the form of kali magnesia (Patentkali) and sulphate of potassium (SOP). While using the first fertilizer (Patentkali) a rate of 80 kg K<sub>2</sub>O and 26.6 kg MgO per ha was applied, and while using the second fertilizer (SOP) a rate of 80 kg K<sub>2</sub>O was applied.

The first series was made on a medium heavy soil in an organic farm located in the village of Zgnioloty, northern Poland. Winter spelt cv. *Schwabenkorn* was grown after red clover in the period of 2007- 2010. The soil pH was neutral and the content of K and Mg was low.

The second series of experiments were made on a heavy soil in an organic farm located in Budiszewo, northern Poland. Winter spelt cv. *Oberkulmer Rothkorn* was grown after ley in the period of 2011- 2014. The soil pH was slightly alkaline, the content of K was low and Mg medium to high.

In the first experiment the average yields of spelt were high: 5.92 and 4.27 t per ha of hulled and de-hulled grain respectively. Mineral fertilization of spelt with potassium and magnesium (Patentkali) increased yield of de-hulled grain by 12.6 and fertilization with potassium alone by 8.0%. The respective figures for hulled grain are 14.4 and 9.3%. Fertilized spelt had bigger 1000 kernels weight and grain fertilized with K and Mg had higher content of protein (by 2.3%) and fertilized with K by 2.0%.

In the second experiment the average yields of spelt were also high: 5.76 and 4.20 t per ha of hulled and de-hulled grain respectively. Moreover the yielding potential of cv. *Oberkulmer Rothkorn* is lower than cv. *Schwabenkorn*. The mineral fertilization of spelt with potassium and magnesium (Patentkali) increased yield of de-hulled grain by 4.3 and fertilization with potassium alone by 4.6%. The respective figures for hulled grain are 4.9 and 5.4%. Neither the 1000 kernels weight nor the protein content differed between spelt fertilized with K and Mg and no fertilized plots.



**Key words:** organic farming, supplementary mineral fertilization, winter spelt wheat, kali magnesia, sulphate of potassium

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## **Reclamation of Land as a Factor of Innovative Development of Agricultural Production and Strengthening of Food Security**

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### **Abstract**

The article is devoted to the role of state planning in meliorative branch. The analysis of implementation of the Republican program and provisions of a new Government program of preservation and use of the reclaimed lands for 2011-2015 in Belarus is made. Special attention should be paid to drainage systems located on contaminated lands. Keeping these systems in working condition and ensuring a favourable water regime for the plant will reduce the discharge of radionuclides into agricultural products. In compliance with the regulatory regime of irrigation and recommended production technologies through irrigation the yield of late cabbage will be – 500 – 600 centners per hectare, carrot – 380 – 420, apples – 380 – 420 quintals per hectare. The cultivation of vegetable crops on irrigated land will enable the Northern zone of the Republic to get yields of late cabbage 10 tons per hectare, early cabbage – 6, late potato – 4,5, early potato – 3, beet – 8, carrots 8 tons, for the South zone respectively 14, 8, 6, 6, 10, 10 tons per hectare. In dry years, the biological effect of artificial irrigation will be higher.

**Keywords:** land reclamation , drainage systems, water regime, farming systems, preservation of lands, irrigation

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## **Influence of the controlled atmosphere in the potassium quantity of Jerusalem Artichoke (*Helianthus tuberosus* L.) Tubers**

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### **Abstract**

The tubers of Jerusalem artichoke typically comprise about 80% water, 15% carbohydrate, and 1 to 2% protein. Jerusalem artichoke tubers have a high mineral content they are especially rich in potassium (150 to 657mg100 g<sup>-1</sup>) (Kays, Nottingham, 2007).

Potassium is a type of mineral called an electrolyte. Electrolytes conducts electrical impulses throughout the body. They assist in a range of essential body functions, including blood pressure, normal water balance, muscle contractions, nerve impulses, digestion, heart rhythm.

**The aim** - to evaluate changes in the potassium quantity of Jerusalem artichoke tubers.

The experiments were carried out at the laboratory of Institute of Agriculture and food sciences at Aleksandras Stulginskis University in 2015 – 2016. Jerusalem artichoke tubers of three varieties 'Sauliai', 'Albik', 'Rubik' were grown in the Petras Tinkevičius ecological farm in 2015-2016. The tubers of Jerusalem artichoke were stored in a three, controlled atmosphere chamber with different gas composition: first - CO<sub>2</sub> – 1.0 %, O<sub>2</sub> – 21.0 %, N – 78.0 %, second - CO<sub>2</sub> – 10 %, O<sub>2</sub> – 3.5 %, N – 86.5 %, three - CO<sub>2</sub> – 15.0 %, O<sub>2</sub> – 5.0 %, N – 80.0 %.

Object of the work – Jerusalem artichoke tubers 'Sauliai', 'Albik', 'Rubik'. By applying standard methods, the change in potassium (mg 100g<sup>-1</sup>) and the dry matter (%) quantity was assessed of Jerusalem artichoke tubers.

The experimental data were statistically processed by the dispersion analysis method (ANOVA), software STATISTIKA 10 (StatSoft, USA). Arithmetic means of the experimental data were calculated. Statistical reliability between data is evaluated by Fisher's LSD test. The differences are statistically reliable when  $p < 0.05$ .

After 12 weeks of storing Jerusalem artichoke tubers in controlled atmosphere chamber, in the gas composition  $\text{CO}_2 - 1.0 \%$ ,  $\text{O}_2 - 21.0 \%$ ,  $\text{N} - 78.0 \%$  the highest amount of dry matter was determined in 'Albik' tubers. In the gas composition  $\text{CO}_2 - 15.0 \%$ ,  $\text{O}_2 - 5.0 \%$ ,  $\text{N} - 80.0 \%$ , 'Rubik' variety tubers demonstrated the highest amount of dry matter.

After 8 weeks of storing Jerusalem artichoke tubers in controlled atmosphere chamber in the gas composition  $\text{CO}_2 - 1.0 \%$ ,  $\text{O}_2 - 21.0 \%$ ,  $\text{N} - 78.0 \%$  'Sauliai' variety tubers demonstrated the highest amount of dry matter. In the gas composition  $\text{CO}_2 - 10.0 \%$ ,  $\text{O}_2 - 3.5 \%$ ,  $\text{N} - 86.5 \%$  the highest amount of potassium was found in 'Rubik' variety tubers.

After 4 weeks of storing Jerusalem artichoke tubers in controlled atmosphere chamber in the gas composition  $\text{CO}_2 - 15.0 \%$ ,  $\text{O}_2 - 5.0 \%$ ,  $\text{N} - 80.0 \%$  the highest amount of potassium was found in 'Sauliai' and 'Albik' tubers.

**Keywords:** Jerusalem Artichoke tubers, controlled atmosphere chamber, potassium.

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## **The Use of Fertilizer Produced from Coal Combustion By-products as a Part of Sustainable Management of Waste Materials**

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### **Abstract**

The aim of this paper was to assess the efficiency of using fertilizer produced from REA-gypsum and fluidized bed combustion ashes (as combustion by-products at coal power plants) in crop production. The scope of the work included laboratory analyses to examine the material for the content of macro- and microelements, and a vegetation experiment to determine its effect on the amount and quality of spring wheat yield and spring rape yield. Moreover, the study determined the impact of the analyzed material on selected physicochemical and chemical properties of soil. The research goal was accomplished based on a vegetation experiment conducted in 2016 on brown soil made from loess. The experiment comprised five treatments which were repeated four times for each cultivated plant. The test plants included spring wheat cv. Monsun and spring rape cv. Belinda. The experimental design included the following treatments: control treatment I – without fertilization, II – with mineral fertilization, and three treatments with different levels of the fertilizer and constant level of NPK fertilization. Calcium content in the investigated product was at the level of 34.2% CaO, sulfur – 23.8% SO<sub>3</sub>, and iron – 1.1%. The heavy metal content was below critical values for fertilizers or plant growth promoters specified in the Act of 10 July 2007 on fertilizers and fertilization (Polish Journal of Laws No. 147, item 1033). The results of the tests did not show any effects of the investigated product on soil reaction or on the content of available forms of calcium, phosphorus, potassium, magnesium and total content of nitrogen and carbon. However, in the treatments in which the analyzed material was applied, we found an over three times higher sulfate sulfur content in the soil compared to the control treatment I and II. The investigated material did not influence the amount of plant yield. In the treatments with successive levels of the mixture of REA-gypsum and fluidized bed combustion ashes, we found a 20% increase in sulfur content in the wheat grain compared to the control treatments. In case of rape, we found a 40% increase in sulfur content. The obtained results showed great fertilizing potential of the examined coal combustion by-products.

**Keywords:** fertilization efficiency, coal combustion by-products, yield quality, soil properties

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## Assessment of Productive and Environmental Efficiency of Slow-release Fertilizers in Integrated Production of Napa Cabbage Depending on Application Method

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### Abstract

The study aimed to assess the suitability of slow-release fertilizers in cultivation of napa cabbage in the integrated production system. The objective was realized on the basis of a strict field experiment set up on soil with granulometric composition of light loam. The dose of fertilizer was the first experimental factor, and the fertilizer application was the second factor. The slow-acting fertilizer was applied under each plant during planting of seedlings and in the second variant. The fertilizer was applied in the row, about 5 cm under the seedling root level. On the basis of the results obtained in the experiments, the indices showing nitrogen fertilization efficiency were calculated. Fertilization significantly modified the quantity of obtained yield. In the control, without mineral fertilization, the crop yield was  $23.32 \text{ Mg} \cdot \text{ha}^{-1}$ . The largest yield was  $52.27 \text{ Mg} \cdot \text{ha}^{-1}$ . Larger yields and more advantageous productive and

environmental efficiency were obtained in objects with row application of fertilizer. The most advantageous agronomic efficiency and nitrogen recovery efficiency were obtained in the combination of 400 kg · ha<sup>-1</sup> of slow-acting fertilizer with traditional supplementary PK fertilizers in the case of point application of fertilizers. In the case of row fertilizer application, it is possible to use 50% more of the fertilizer dose without compromising the quality of the crop. Higher doses of free-acting fertilizers increased the standard deviation of the mass of cabbage, which is not desirable for production. The results show that under conditions of low mineral content in the soil, the slow-acting fertilizers can be used at a low level.

**Keywords:** napa cabbage, integrated production, slow-acting fertilizer, fertilization efficiency

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## **Content of Trace Elements in Fodder from Sward of Grasses and Legumes from Selected Organic Farms in Poland as a Criterion of Fodder Quality**

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### **Abstract**

Under organic production conditions, limited fertilization may lead to improper management of plant nutrients. As a result, deficiency of some elements in soil may occur, which translates into a change in the chemistry of cultivated plants, and later – into a decrease in the amount and quality of crop yields. The aim of this paper was to assess the quality of sward from selected organic farms in the context of using it for feed purposes. 55 organic farms were selected for the research; 25 of those farms additionally had conventional animal production. Sward samples of mixed grasses and small-seed legumes were collected from each farm. Content of selected elements (Fe, Mn, Cu, Zn, Cd, Ni, Cr and Pb) was determined in the plant material. All of the studied samples had the optimum copper content for good quality fodder, whereas the content of zinc was generally too low. A very high content of iron and manganese was observed in all of the studied samples. The mean content of iron in the samples was approximately 8 times higher, and manganese – approximately 3 times higher than the optimum content of these elements in fodder. A high content of potentially toxic elements such as Cd, Pb (which would disqualify the sward from being used as a fodder), as well as Cr and Ni was not observed. The animal production farms were found to have a lower mean content of zinc and lead in sward as compared to farms without animals; in the case of the content of other analyzed elements, the differences between the two groups of farms were small. Feeding cattle only with roughage obtained from the studied lands could pose a risk to the health of the animals and their productive abilities owing to the unfavorable chemical composition (e.g. high content of some elements can cause problems with absorption of other elements, especially occurring in sward in small amounts).

**Keywords:** sward, organic farming, heavy metals, iron, manganese

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**BIOSYSTEMS ENGINEERING AND  
ENVIROMNMENT**

## Soil Erosion Vulnerability in the Cultivation of Energy Plants in the Conditions of the Czech Republic

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### Abstract

With the growing energy demand of the society and the increased requirements for ecological aspects of obtaining and utilizing energies, renewable energy sources have been getting to the forefront. In the conditions of Central Europe, transformation of biomass to biogas through anaerobic digestion appears to be promising. The article describes the results of a field experiment carried out in an experimental site of the University of South Bohemia in České Budějovice (South Bohemia, Czech Republic). The goal of the article is to compare the conventionally grown corn (*Zea mays* L., hybrid Simao), the areas of which have increased considerably as a result of the development of biogas stations, and the alternative perennial grass called tall wheatgrass (*Elymus elongatus* subsp. *ponticus* cv. Szarvasi-1), which is, according to the literature, well positioned to replace corn. The harvests of the plants took place in 2013-2015, and tall wheatgrass was cut twice per season. A number of aspects – dry phytomass yield, specific methane yield and hectare methane yield – were monitored. In addition, the long-term soil loss by water erosion was calculated through the Universal Soil Loss Equation for both species of energy crops. In terms of yield parameters and methane production, better results were achieved by corn, given the average energy gain 238 GJ·ha<sup>-1</sup> as compared to 126 GJ·ha<sup>-1</sup> for tall wheatgrass. The protection of the soil surface from water erosion by corn appears to be insufficient and, in this criterion, it absolutely lags behind the anti-erosion abilities of tall wheatgrass, which protects soil incomparably better.

**Keywords:** corn, erosion, methane, tall wheatgrass, yield

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## **Impact of Using Photovoltaic Panels in Piggery on Greenhouse Gases Emission**

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### **Abstract**

Farm buildings have a large area of unused roofs. This makes it possible to use photovoltaic panels without limiting the area of agricultural land. In piggeries the largest demand for electricity has the ventilation system. The daily distribution of electricity demand largely corresponds to the diurnal variation of solar irradiance. This allows immediate use of the energy produced by photovoltaic panels.

The aim of the study was to determine the reduction level of greenhouse gases emission by the use of photovoltaic panels to supply the electricity to the fattening house for pigs. The research was carried out in deep-litter piggery for 1000 pigs (140 Livestock Unit) located in the Wielkopolska voivodship. It was assumed, that the PV panels were installed on the whole gable roof (24 m of width and 48 m of length; slope angle 20°). It was possible to mount 224 panels (Selfa SV60P-245; maximum power 245 W, efficiency 15%) at the angle 45°. The amount of electricity supplied by the panels to the electrical installation of the piggery was calculated on the basis of solar irradiance and technical parameters of PV panels. The demand for electricity in each month was determined based on the timing of devices and their energy consumption.

The designed on the whole roof photovoltaic system did not cover the electricity demand of the piggery. The total electricity demand was 90913 kWh yr<sup>-1</sup>, and the PV panels can provide 72914 kWh yr<sup>-1</sup>. So, the annual deficit was 17999 kWh yr<sup>-1</sup>.

Using the CH<sub>4</sub> (18.1 kg pig<sup>-1</sup> yr<sup>-1</sup>) and N<sub>2</sub>O (0.78 kg pig<sup>-1</sup> yr<sup>-1</sup>) emissions factors, the annual greenhouse gas emissions from the piggery were calculated.

Expressed in CO<sub>2</sub> equivalent, it was equaled to 647.2 Mg CO<sub>2</sub> eq. yr<sup>-1</sup>. The carbon dioxide emission from pigs were excluded, because CO<sub>2</sub> was consumed by photosynthesis process of plants for animal feed. The CO<sub>2</sub> emission reduction resulting from the use of photovoltaic panels was calculated using the emission factor for Polish electricity - 798 kg CO<sub>2</sub> MWh<sup>-1</sup> and it amounted to 58.2 Mg yr<sup>-1</sup>. The use of PV panels on the roof of studied piggery may reduce greenhouse gas emissions by 8.1%.

**Keywords:** PV panels, carbon dioxide emission, farm building, renewable energy

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## Environmental Assessment of Livestock Farms in Russia

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### Abstract

Currently the reforms of environmental legislation are in progress in Russia. The creation of Russian BAT reference books on intensive livestock farming also continues. The latest version of European BREF on intensive rearing of pigs and poultry is used as an analogue.

One of the debating points in this work is assessment of environmental impact of large-scale livestock farms since special targeted studies aimed at determining the emission factors of livestock farms have not been recently conducted in Russia. The criteria and indicators for such assessment must be easily understood by both scientists and farmers; they have to be comparable, measurable and formalisable.

The testing results of the calculation methodology of nitrogen balance for agricultural enterprises in Leningrad Region showed that nitrogen use effectiveness (NUE) as an integrated index of environmental load meets these requirements.

The viability of manure storage and spreading techniques recommended by European BREF, namely compost heaps covering and immediate incorporation of organic fertilisers after spreading, was estimated on the example of a crop-animal production farm in Leningrad Region with 3000 ha of farmland and 718 cows with the milk yield of 7000 kg/year average. The estimated value of lower total nitrogen losses and lower input of mineral fertilisers owing to higher nitrogen content in field-applied organic fertilisers can be 20%. According to the calculated farm-gate balance the nitrogen surplus was 48.3 kg/ha, which is below the limit values and indicates the possibility to increase the application amount of nitrogen fertilisers. However, the coefficient of nitrogen use efficiency  $NUE=0.21$  is significantly below the European average.

When farms are assessed on the stage of integrated environmental permit issue it is feasible to use the measured air concentrations of hazardous substances in animal houses and gases within the sanitary zones of farms and the estimated whole-farm environmental impact by nitrogen use efficiency.

**Keywords:** environmental impact, farm-gate balance, livestock farms, nitrogen use efficiency

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## **The Effect of Sewage Sludge on and Cup Plant’s (*Silphium perfoliatum* L.) Biomass Productivity Under Western Lithuania’s *Retisol***

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### **Abstract**

The substitution of traditional fuels by plants biomass requires the choose crop species with high local adaptability and high biomass productivity. The long term field experiment with new high yielding perennial energy crop - cup plant (*Silphium perfoliatum* L.) was conducted in order to evaluate its biomass productivity under naturally acid *Bathygleic Dystric Glossic Retisol*, pH 4.2-4.4. Experimental site – Vėžaičiai branch of the Lithuanian Research Centre for Agricultural and Forestry (Western Lithuania). To decrease growing expenses, granulated sewage sludge was applied (at 45 and 90 t ha<sup>-1</sup> rates) as an alternative organic fertilizer. The fertilization was done at the beginning of the experiment, prior to cup plant’s seedlings planting in 2013. Each experimental year, traditional N<sub>60</sub>P<sub>60</sub>K<sub>60</sub> fertilization was performed in a separate treatment. Cup plant’s biomass was harvesting once in each year at the end of vegetation.

According the results of three experimental years, cup plant’s dry mass (DM) yield substantially increased from 2.80 t ha<sup>-1</sup> (in 2014) to 13.41 t ha<sup>-1</sup> (in 2016), on average. Subsequently, cup plant’s yield increased with increasing number of stems and the mass of those stems. The use of sewage sludge fertilization was notably superior to that of mineral fertilization for cup plant’s biomass productivity. In all experimental years, the optimal was the application of 45 t ha<sup>-1</sup> rate of sewage sludge - in compare with unfertilized treatment (control), DM yield increased by 66%, on average. Further increasing of sewage sludge rate up to 90 kg ha<sup>-1</sup> did not give any DM yield supplement. In turn, energy evaluation of growing technology revealed that the application of 45 t ha<sup>-1</sup> sewage sludge rate caused the substantial increase of energy output from 1 ha; and on the contrarily, sharply decreased energy use efficiency (energy output/input ratio).

In order to determine the long-term effects of fertilization, these studies will continue for several years.

**Keywords:** cup plant, sewage sludge, NPK, DM yield, energy evaluation

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## Evaluation of Chemical Content in Different Energy Crops

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### Abstract

Within the territory of Latvia grass biomass currently is considered to be one of the alternative sources for pellet production in Baltics and Northern Europe. This grass plant is characteristics with persistence to local climatic conditions and high biomass yield from 1 ha. The field trial was carried out during 2011-2013 in research and study farm "Peterlauki" (56°53'N, 23°71'E) of the Latvia University of Agriculture, in the sod calcareous soils pH KCl 6.7, containing available for plants P 52 mg kg<sup>-1</sup>, K 128 mg kg<sup>-1</sup>, organic matter content 21 to 25 g kg<sup>-1</sup> in the soil. The field test fertiliser norms applied were following (kg ha<sup>-1</sup>): N0P0K0 (control) P<sub>2</sub>O<sub>5</sub> - 80, K<sub>2</sub>O - 120 (F - background), F+N30, F+N60, F+N90, F+N120 (60+60), F+N150 (75+75), F+N180 (90+90). Research objects: reed canary grass (*Phalaris arundinacea* L.), festulolium (× *Festulolium* Asch. & Graebn.), tall fescue (*Festuca arundinacea* Schreb.), and timothy (*Phleum pratense* L.) that are perennials yielding for 8 - 10 years, plant length up to 1.5 m. The carbon content in the reed canary grass dry matter was observed to be on average 38.3% ± 0.5%. Hydrogenic content in the reed canary grass dry matter was on average 6.26% ± 0.06%. During the research a ratio was observed H:C 1:6. Hydrogenic content is an important indicator, as it is one of the criteria, which determines the burning qualities of fuel. Sulphur content in energy crops were 0.10±0.01%. For the reed canary grass, festulolium, tall fescue, timothy, the sulphur content was dependent ( $p < 0.005$ )

on the growth year (66.9%) and N fertilizer rate (2.2%), and on the interaction between the growth year and the N additional fertiliser contribution amount (22.4%). That means; that the air temperature and the amount of precipitation, in the plant growth period, are of great importance. The research into energy-crop plants has great prospects. When starting to grow them it is necessary to find out the heating systems for which, the biomass after processing, will be used; from the information the necessary plant energy parameters can be evaluated.

**Keywords:** energy crops, carbon, sulphur, hydrogenic content, fertilizer nor

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## The Production and Consumption of Bioenergy in Poland in the Context of Bioeconomy Development

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### Abstract

Growing demand for energy, along with the depletion of traditional fossil fuels and the development of civilization, raises interest in the use of bioenergy in all sectors of the economy, including electricity, transport, heating, cooling, and industry. In developed countries bioenergy is an alternative to traditional non-renewable energy (fossil fuels), as its resources renew in natural processes, making it practically inexhaustible. In addition, due to the reduction of greenhouse gas emissions, production of bioenergy is more environmentally friendly than fossil energy.

Bioenergy sector, including the use of biomass for food, feed, materials and chemicals, is a key segment of bio-economy and determines its competitiveness and development in the country. Increase in bioenergy production, resulting



from both market and energy policies, leads to greater interdependence between energy and agricultural markets, affects food and feed prices and change in land use.

The aim of this study was to identify changes in the bioenergy market in Poland in 2010-2015, present the role of bioenergy sector production in the structure of bio-economy, evaluate changes in production and directions of biomass-based energy use and determine the importance of the major bioenergy markets in the structure of the energy market in Poland.

The study was based on the aggregated statistical data on the acquisition and consumption of bioenergy in Poland, including energy from municipal waste, solid biofuels, biogas, liquid biofuels (for transport).

Findings prove that bioenergy is the most important renewable energy source in Poland. It is also a diversified source of energy, as unlike other sources, biomass can be converted into solid, liquid and gaseous fuels. Although solid biofuels and liquid biofuels dominate in Poland, the share of biogas and energy produced from municipal waste is small. Concluding, bioenergy in Poland changes its character from traditional and local energy source into modern, international commodity.

**Keywords:** bioeconomy, bioenergy, Poland.

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## **Subsidised Electricity Tax on Biogas Production in Latvia**

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### **Abstract**

Biogas production becomes increasingly popular in Latvia. The development of the biogas industry depends on national and European Union (EU) support, as biogas production is not economically efficient without the support. In 2014 Latvia introduced a new tax – the subsidized energy tax (SET) – that influences all biogas producers in the country. A 10% tax rate is applied to incomes gained from: 1) electricity sold under the mandatory purchase obligation; 2) guaranteed payments for the electrical capacity installed in a cogeneration plant or a power plant. However, there is an opportunity to apply the reduced SET rate of 5%. This is a government support scheme that may be applied to the tax payers that meet the criteria for effective thermal energy use: the operation of biogas facilities, the production of products or their sale to a related person, thereby ensuring the operation of the enterprise. For this purpose, the biogas facility has to be equipped with meters for measuring thermal energy generated; accurate readings of the meters at the generator output have to be specified in monthly tax reports. The research analyzed the fiscal effects of the SET on biogas production enterprises and opportunities for the reduced SET rate to be applied. The reduced SET rate is paid by 29 out of 61 (28%) biogas producers listed in the Register of Subsidized Electricity Producers. The research employed analysis and synthesis, logical construction, the monographic method and statistical analysis and performed calculations. The authors assessed the situation at four biogas production enterprises that were different in terms of output capacity and inputs used. An analysis of gross profit margins allowed concluding that there were considerable differences in expected gross profit margin among various producers: from 13% to 50%, which would be able to influence their decisions to construct a biogas facility if the SET situation were known.

**Keywords:** biogas production, subsidized energy tax, expected profit.

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## **Automatic Concentrate Distribution for Fattening of Romanov × Dorper Lambs**

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### **Abstract**

The aim of this research was to study the possibility of using automatic concentrate feeding stations in fattening of lambs. Ten Romanov × Dorper weaned male lambs (initial live weight  $21.0 \pm 0.86$  kg) for fattening were used. Lambs were kept indoors in a separate pen and the research was carried out in production conditions. Concentrate was distributed for animals individually via an automatic feeding station. Adaption period was not applied; eight lambs consumed concentrate at the automatic feeding station from the first day of research, one started consuming concentrate from the third day of research and one - from the eleventh day of research. The frequency of visits to the automatic feeding station and daily concentrate intake was recorded and analysed. Lambs were weighed before research and every fourteen days, and live weight changes were analysed. During all the research period the mean number of daily visits to the automatic feeding station by one lamb amounted to 13, average daily concentrate intake of one animal was 84% of average ration (1642 g) throughout the research period. The results show that average daily live weight gain was  $0.246 \pm 0.0263$  kg, while during the last two weeks of the research daily live weight gain ( $0.089 \pm 0.0277$  kg) was significantly lower ( $p < 0.05$ ) than in other periods. For 1 kg lamb live weight gain 5.39 kg of concentrate were used.

**Keywords:** *sheep, live weight gain, feeding, pellets*

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## Research of the Defective Frog Wing of 1/11 Mark 60 e1 do 04 07

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### Abstract

The paper is devoted to the research of the defective frog wing of 1/11 mark. In the course of the research, the analysis of arrow defects on the Latvian Railway was carried out for eight compartments of the track distance during 2014, 2015, 2016. The defect of the frog wing of 1/11 mark (the **60 E1 DO 04 07** frog type) was considered according to the basic classification of the defects, and the analysis and research of the cause of its fracture were made.

The research process was consisted of four stages:

- The first stage: determination of the metal hardness according to the Brinell scale with the **Krautkramer** modern device. The obtained results should be compared with the data of the Austrian manufacturer's factory.
- The second stage: determination of the chemical composition of the rail steel of the frog wing 1/11 (in the rail top, rail web, and rail base) using the **ARC-MET 8000 Mobile Lab** Optical Emission Analyzer. The obtained data should be compared with the manufacturer's data, as well as with the data of the standard.
- The third stage: determination of the the rail steel structure. To draw the main conclusions about the quality of the rail steel of the frog wing of 1/11 mark.
- The fourth stage: to draw the main conclusions and opinions about the cause of the fracture of the frog wing of 1/11 mark.

**Keywords:** top, web, base, frog, mark, hardness, elements, metal, metal structure

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## **EU Regional Policy Support for Bioenergy Sector in Poland in 2007-2013 (2015)**

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### **Abstract**

The EU faces increasing climate, social and economic challenges resulting among others from the negative effects of using fossil fuels. Bioeconomy with its flagship bioenergy sub-sector is meant the key remedy for this situation. That is why the growth of bioenergy production has been promoted and supported in EU financial perspective of 2007-2013 by allocating regional policy funds to strengthen bioenergy sub-sector under operational programs in eligible member states. As Poland has increasing needs to develop bioenergy sector and has been the biggest beneficiary of EU regional policy funds the aim of the paper was to investigate on the main effects of investments in bioenergy sub-sector under operational programmes 2007-2013. The study was based on SIMIK data from the Ministry of Regional Development as of December 31, 2015 and Local Data Bank of the Central Statistical Office of Poland and CATI with some of the beneficiaries. Qualitative and quantitative analysis show that beneficiaries carried out 80 bioenergy projects of 1442,8 mln PLN total value, including 30,4% EU co-funding under Operational Programme Infrastructure and Environment and 14 Regional Operational Programmes. These bioenergy investments resulted mainly in construction and modernization of biomass power plants, of which nearly 50% were agricultural ones as well as in constructing new and expanding already existing biomass-based heating systems in public institutions. Findings show big regional differentiation of the bioenergy investments: from none in mazowieckie (the biggest NUTS 2 in Poland) and opolskie to cumulation of nearly 33% of bioenergy projects under OPs 2007-2013 in warmińsko-mazurskie. EU co-funding for individual projects ranged from 15% to 85%, however for nearly half of them it was higher than 45%, conditioning realization of the projects fully. Concluding, EU funding was a significant source of financial support for bioenergy sub-sector in Poland, resulting in developing it especially in warmińsko-mazurskie voivodship.

**Keywords:** EU regional policy, renewable energy, biomass, Poland.

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## Attitudes of Academic Youth Towards Welfare of Farmed Animals

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### Abstract

The development of agriculture and rural areas depends to a large extent on the level of social awareness on agriculture. One of the areas of agricultural awareness of citizens is their attitude towards the welfare of farmed animals. The findings of many studies indicate that the level of social awareness in Poland in this area is low, especially among young people. The aim of the study is to determine the attitudes of Polish academic youth towards the welfare of farmed animals and pinpoint selected factors determining this level. Being familiar with these determinants might serve as the basis for taking some actions by various entities which contribute to the increase in the positive influence on the attitudes of young generation towards the welfare of farmed animals.

The main source of the data used for the analyses and applications was the primary information obtained from personal research. The research was done in 2016 by using PAPI method on the group of 450 people. The statistical analysis of the studied material encompassed aggregate statistical indicators as well as the non-parametric test „chi square” ( $\chi^2$ ). All hypotheses were verified on the significance level  $\alpha = 0.05$ . Apart from the primary sources they also used secondary sources which encompassed both domestic as well as foreign literature.

The completed studies among Polish students enabled the assessment of the level of farmed animal welfare awareness of academic youth and the identification of factors determining and diversifying this level. According to the conducted study, the majority of the participants had an average level of farmed animal welfare awareness (55%). One in three respondents had a low level of farmed animal welfare awareness, and the remaining group represented the high level. The determining factors were: gender, studied faculty, place of residence, and ownership of agricultural holding by the respondents or their

parents. A higher level of farmed animal welfare awareness was characterized by women, students of humanistic faculties, people from rural areas as well as the respondents who didn't run a farm. For most students the main source of information about animal welfare is the Internet.

**Keywords:** academic youth, animal welfare, farm animals

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## Biomass Ash Utilization Opportunities in Agriculture

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### Abstract

In Latvia and in the world there are problems with utilization of wood ash from large fireboxes because it is a technologically complicated, time consuming and costly process. The methods used to dispose of the ash when it is deposited in waste landfills are unsustainable. Pollution-increasing solution is needed since pure wood ash is a valuable source of plant nutrients. Ash contains the macro and microelements needed for plants and can replace some of the precious mineral fertilizers in agriculture, especially in organic. Ash use in agriculture is little explored and implemented, the use of the technology is not resolved (ash collection and screening, fractionation, drilling, evaluation, etc.). The LUA studies of ash and slurry mixing problem to prepare ash with mechanized spreaders. Cattle slurry is used as a binder that helps create solid ash fractions that are subject to dispersion with centrifugal fertilizer dispersers with a sufficiently good spreading quality. The research examines the conditions for the creation of different size fractions and their dissolution.

**Keywords:** mixing, slurry, solid fraction, wood ash



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## **Biogas Potential of Digestate After Fermentation of *Sida Hermaphrodita* Silage**

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### **Abstract**

Lignocellulosic biomass is one of the most widely used substrate in methane digestion. Among plants with a high yield potential, *Sida hermaphrodita* is particularly noteworthy, due to Sida can be grown on low quality soils and its utilization for energy purposes is not competitive with food crops. Methane fermentation of the biomass with such a complex structure usually require application of pre-treatment methods for efficient utilization of its cellulose and hemicellulose. It is economically justified to control of the digestate, if substrate was efficiently used. The study aimed to measure the biogas potential of digestate after fermentation of *Sida hermaphrodita* silage. The post-fermentation of two samples of the digestate from the reactors operated at organic compounds loading of 2 kg/(m<sup>3</sup>·d) – S1 and 3 kg/(m<sup>3</sup>·d) – S2 was performed. Hydraulic retention time in these reactors was 50 d and 33 d, respectively. The biogas potential of the fermented sludge was measured with the use of AMPTS II (Bioprocess control). Biogas production was 0.012 L/g TS and 0.031 L/g TS from the digestate S1 and S2, respectively. The methane content in the biogas was 15% from the digestate S1 and 50% from the digestate S2. The obtained results suggest that the digestate from the reactor with organic compounds loading of 3 kg/(m<sup>3</sup>·d) still has high biogas potential, and the hydraulic retention time in this reactor should be prolonged.

The study was carried out in the framework of the project under program BIOSTRATEG funded by the National Centre for Research



and Development No. 1/270745/2/NCBR/2015 “Dietary, power, and economic potential of *Sida hermaphrodita* cultivation on fallow land”

**Keywords:** post-fermentation, *Sida hermaphrodita* silage, organic compounds loading, hydraulic retention time

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## Efficiency of Anaerobic Decomposition of Manure from Cattle Fed With *Sida Hermaphrodita* Silage

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### Abstract

The study aimed to determine the influence of addition of *Sida hermaphrodita* silage into cattle forage on efficiency of methane fermentation of cattle manure. Efficiency of methane fermentation connected with amount and composition of produced biogas was determined with respirometric tests. Methane fermentation was performed in mesophilic conditions with initial organic compounds loading of 5 g VS/ (dm<sup>3</sup>·d). The study was divided into two stages. In first stage, substrate in methane fermentation was only cattle manure. In second stage, substrate in methane fermentation was cattle manure and *Sida* silage. There were three series of experiments in each stage, due to cattle

manure was obtained from cattle fed with forage differ in contribution of Sida silage (0 – series 1, 17% - series 2, 34% - series 3).

In the stage 1, biogas production of 223±15 L/kg VS, 247±8.5 L/kg VS and 231±18 L/kg VS was noted in the series 1, 2, and 3, respectively. The addition of Sida silage to the cattle forage had no impact on biogas potential of cattle manure. In the stage 2, the same tendency was observed. No differences in biogas composition between series was also observed. Methane content in biogas was about 60%.

**Keywords:** biogas, cattle manure, *Sida hermaphrodita*, anaerobic process,

**The study was carried out in the framework of the project under program BIOSTRATEG funded by the National Centre for Research and Development No. 1/270745/2/NCBR/2015 “Dietary, power, and economic potential of *Sida hermaphrodita* cultivation on fallow land”**

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## Valuable Energy of Biochar From Agricultural and Forest Waste Streams

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### Abstract

Waste from forest and agricultural industry are still insufficiently used. One of the ways of their preprocessing is a pyrolysis process. Therefore, the aim of this study was to determine the energetic properties of biochar from walnut husks, forest wood chips and willow chips. The studies were performed according to standards. The moisture content of the material, the ash content, the net and gross calorific value were determined. Low moisture and ash content were found in each of the biochar species. For all tested samples the ash content was lower than 6% and for wood chips it was 1.5% only. The way of processing the biomass in the pyrolysis process significantly increased the calorific value of the raw material. It was found that the net calorific values of the tested materials were high and reached the amount of 26.58 MJ·kg<sup>-1</sup> for biochar made of walnut, 22.29 MJ·kg<sup>-1</sup> for biochar made of forest wood chips and 24.59 MJ·kg<sup>-1</sup> for biochar made of willow chips. Due to the good physical properties of biochar produced from waste and biological materials, it was found that these solid fuels can be used for energy purposes.

**Keywords:** waste streams, biochar, energy properties

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## Contribution of Agricultural Sources to Nutrient Load Generated on the Russian Part of the Baltic Sea Catchment Area

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### Abstract

Agricultural production is one of the main sources of nitrogen and phosphorous inputs to the water bodies. Quantifying nutrient input from agriculture is needed both to develop effective environmental measures and to justify the technologies to be applied with due account for local natural and climatic conditions. Several related national studies have been conducted since 2015. IEEP methodology was used for this purpose. It determines nitrogen and phosphorus content in the arable layer, including the amounts applied with mineral and organic fertilizers. Such factors as soil type and texture, the distance to the water bodies and the land use structure are used to estimate the nutrient input to the water bodies. In addition, the consistency of manure handling technologies with BAT principles is taken into account through introduction of relevant coefficients. Calculation results according to IEEP methodology were used in the follow-up general assessment of the nutrient load on the Baltic Sea from different sources. The Institute of Limnology Loading Model was applied. Satisfactory correspondence between the assessment results and the values calculated using the monitoring data confirmed the adequacy of the above assessment procedure. Following its outcomes the nutrient reduction potential of agricultural sources is approximately 10-25 %.

**Keywords:** nutrient load, water bodies, Baltic Sea, reduction potential, agricultural sources

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## **Assessment of Reed Potential for Heat Extraction in Latvia**

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### **Abstract**

Global challenges like increasing population density and climate changes are putting focus on such emerging issues as transition to green economy and mitigation of greenhouse gas emissions. Starting from 2021 activities in climate protection will launch the Paris Agreement, which provides not only adapt to already occurring climate changes and reduce the expected effects, but also promote investment flows in carbon low economy. In Latvia, one of the largest greenhouse gas emission sources are heat extraction from fossil fuel. Although biomass combustion generates about the same amount of carbon dioxide as fossil fuel, this is friendlier source of energy because when it is restored the carbon dioxide from atmosphere is absorbed. Currently the most commonly used renewable resource for extraction of heat is wood. In this study author has explored the possibility of using other types of biomass - reeds, which is common resource, available throughout the country and recovers quickly. The following materials were used in this study: theoretical and statistical sources of information, publications, the Latvian legislation and European Union regulations. For information processing the following methods were used: logical constructive; analysis of documents, graphic; synthesis; monographic or descriptive; comparative; horizontal or dynamic analysis. The study results

showed that the reed can be used as an environmentally friendly alternative fuel wood, but its efficient use should take into account the following factors: biomass with low humidity obtainable late in winter, the combustion process has a high ash levels and before transporting it should be primary treatment to increase the bulk density and reduce transport costs. Reed as a separate fuel material is effective for solids boilers, close to the resource extraction site. Optimal use of this biomass resource is possible in combination with other heat resources to form pellets or briquettes.

**Keywords:** reed, heat, renewable energy.

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## **The Influence of Biophysical Factors on Productivity and Biochemical Composition of the Blood of Sheeps**

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### **Abstract**

As the livestock industry, sheep breeding takes the third place in the world, this is one of the most extensive types of agriculture. Currently, the main attention in the sheep breeding is directed to increasing in meat productivity and improving the quality of products. The important technique that contributes to the increase and improvement of the quality of livestock production is the use of laser radiation. The article presents the results of research directed to studying of influence of low-intensity laser radiation on the organism of young sheep. The area of impact of laser radiation on the animal organism is defined. The positive influence of laser radiation on the growth and development of young sheep and their immune reactivity is established. The revealed regularity is confirmed by the bigger size of the live weight, increased energy of growth in

all studied periods of ontogenetic development, the more developed factors of natural protection at the experimental animals. The effectiveness of the directed impact of laser puncture on the organism of young sheep has been proved to improve meat productivity and resistance. The developed method of laser puncture can be used to increase the meat productivity, safety and resistance of young sheep.

**Keywords:** animal husbandry, laser puncture, productivity, resistance, sheep breeding.

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## Bioethanol from Straw and its Public Acceptance

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### Abstract

The consequences of global warming and the need for a reduction in greenhouse gases have led to dramatic changes in the automotive sector. Whereas the use of biofuel increased continuously over the first decade of this century, e-mobility has been deemed by politicians and the media alike. As the development of the electric car, rechargeable batteries and charging stations are far from being fully explored, biofuels will play an important role as a bridging technology over the next 20 years.

The successful use of biofuels requires its widespread acceptance by consumers. To evaluate the public opinion towards biofuels, the University of Applied

Sciences Upper Austria carried out a representative opinion poll to collect information on the population's acceptance of biofuels.

The result indicates that there is a lack of interest and information about biofuels, especially among young people and women. First generation bioethanol is strongly associated with the waste of food, but the acceptance of the second generation, produced from agricultural remnants like straw from wheat or corn, is considerably higher. The interviewees see more transparent, objective and less technical information about biofuels as an essential way to increase the level of information and the acceptance rate. Based on this survey, interviews with important stakeholders were held to discuss the results and collect recommendations. In summary, the introduction of biofuels must be accompanied by information campaigns if biofuels should ever reach larger market shares. The irritations caused by the manipulation of the software on the part of several automobile manufacturers of Diesel engines could pave the way for this. So, future decentralized bioethanol plants could play an important role in biofuel production and contribute to the development of rural areas.

**Keywords:**

Biofuels, Bioethanol; advanced biofuels; lignocellulose; straw; public acceptance; opinion poll

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## Diversified Production and Bioenergy Conversion for Rural Development

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### Abstract

The paper substantiates the mechanical and technological principles of formalizing the structure of agroecosystems on the basis of optimizing the interdependence between the elements of the agroecosystem within a specified range of conditions. The equipment for the production of bioenergy resources is improved by means of minimizing its energy capacity with all qualitative indices of the technological processes preserved. A simulation model of agricultural production functioning with grown winter wheat, corn silage and grain, winter canola, barley, sugar beets and grasses is shown. The model involves the production of meat of pigs and cows, fish, milk, eggs, oil, sugar and honey, mushroom cultivation and production of compost. The proposed model involves the production of biodiesel and bioethanol in the amount necessary to ensure that mobile equipment and biogas for heat and power.

**Keywords:** *agro-ecosystems, energy, conversion, straw, biodiesel, biogas*

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## Farmers' Exposure to Noise and Vibration in Small and Medium-Sized Farms

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### Abstract

Occupational noise, hand-arm and whole-body vibration are the main human health risk factors in various economic activity sectors including agriculture. Workers of agricultural sector are usually under increased risk as their exposure to these risk factors is usually longer than reference 8 hours. Moreover, most agricultural activities are related with the processes which include multiple equipment and machinery therefore noise and vibration exposure analysis is a complex issue which is usually undeservedly simplified. This problem can be emphasized by statistical data provided by State Labour Inspectorate of the Republic of Lithuania. Occupational diseases registered for farmers, agricultural and forestry workers consist 16% of all those registered in Lithuania. Four of five occupational diseases registered in Lithuania are related to vibration and noise (musculoskeletal (66%) and hearing loss (13%)) and has the increasing tendency over the last years. These tendencies demand a deeper analysis of noise and vibration exposure of farmers and farm workers as obtained results could help to specify the strategy or procedure to reduce negative exposure effects.

**Keywords:** noise exposure, noise level, vibration.

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## Evaluation of Giant Knotweed and Miscanthus as Perspective Energy Plants and Assessment of Produced Biofuel Quality Indicators

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### Abstract

Giant knotweed (*Fallopia sachalinensis*) was chosen as a perspective energy plant because it is not a soil demanding plant and belongs to the most efficient herbs in Central Europe as regards high biomass yield. Miscanthus (*Miscanthus sinensis*) was chosen as a control one. Knotweeds are comparable to wood briquettes and pellets because of their similar parallel mechanical and thermal features. These plants grow in forest environment with an approximate yield productivity of 15 t ha<sup>-1</sup> d.b. (dry basis). Experimental research investigations were performed in the laboratories of Aleksandras Stulginskis University. Giant knotweed and miscanthus biomass was cut, chopped, milled and granulated with a small capacity granulator (250–300 kg h<sup>-1</sup>). Quality parameters of plant preparative and use for energetical objectives were determined. Plant chaff and mill fraction compositions were determined, and quality indicators of the produced pellets were measured – moisture content, density, resistance to compression, elemental composition, ash content and calorific value, also bulk density, fall and natural slope angles. Moisture content reached 7.8 ± 0.8 %; pellet density was 1227.3 ± 48.6 kg m<sup>-3</sup>. Resistance to compression of giant knotweed pellet was 850 N. Determined ash content was 4.3 ± 0.01 %, and net calorific value of knotweed dry mass was of sufficient height and reached 18.96 ± 0.28 MJ kg<sup>-1</sup>. Bulk density reached 509.9 kg m<sup>-3</sup>, natural slope angle was 31.7 ° and fall angle was 49.3 °.

**Keywords:** ash content, calorific value, density, elemental composition, knotweed, miscanthus, pellets.

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## **Contamination of the Root Vegetables Wash Water and its Treatment Efficiency**

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### **Abstract**

Growing volume of washed vegetables in Europe and Lithuania means that more drinking water is consumed and more wastewater is produced. Farmers, who engage in washing vegetables, face the problems of wastewater treatment, wastewater storage and utilization. Wastewater released to the environment from their farms would meet hygiene and environmental protection criteria. In this article the contamination of wastewater, produced by washed root vegetables, in four large Lithuanian farms was measured according to suspended solids (SS), BOD, COD, total nitrogen and total phosphorus. Contamination of the wash water and wastewater was evaluated comparing the mean values with legislative limit values and with typical sewage contamination values. In all farms wastewater of initial root vegetables washing was treated in settling basins. Wastewater of one carrots washing farm was treated in the natural wastewater treatment system of constructed wetland and two biological ponds. Wastewater treatment efficiency according to various pollution parameters was calculated. The result shows, that the natural wastewater

treatment system with constructed wetland and biological ponds is suitable for farms, that wash and produce vegetables, but before releasing wastewater to the environment, it has to be settled.

**Keywords:** vegetable washing, wastewater treatment

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## Mathematical Model for the Heat Exchange of Greenhouse and Solarium Soil in the Plant Root Area

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### Abstract

This paper proposes a structural mathematical model of heat exchange into the soil of a solarium. The model investigates the possibility of a rational choice of the cooling water transit time through the pipeline network located in the plant root area. Also, the size of the cooled root area is roughly determined, according to the temperature of the cooling fluid. At the same time, the model provides information on the degree of soil cooling, meaning the ratio between the average soil temperature in the cooled root area and a reference temperature, for example the temperature indicated by a sensor into the soil, at a distance fixed to the root axis. The model considered is a plan one. Geometric is considered a section through the soil, perpendicular to the axis of the pipe carrying the cooling fluid. The soil, the copper pipe and the water are the components of the model. The finite elements for meshing are flat, triangular. This simple model prepares a three-dimensional complex approach and has, as a preparation, a unidimensional model. Obviously, this model provides some start-up indications for achieving the physical model and content of the process

parameter set. After its realization, the physical model will be used for the optimal control of the cooling process in the radicular area, but also for the validation and the improvement of the theoretical model.

**Keywords:** heat exchange, mathematical model, root area

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## Testing the Quality of Spraying Fluid by Using Various Nozzles in Special Devices Lechler Droplegul

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### Abstract

A variety of devices that help to prevent drops of sprayed pesticides from getting into places that are difficult to reach (e. g. under the leaves of cultural plants or on the stem), is offered. Special devices Lechler Droplegul<sup>UL</sup> are designed in a way that nozzles that are embedded in the end of the spraying pipe which is bended backwards, spray diagonally upwards.

Data of the quality of spraying fluid by using various sprinklers in special devices Lechler Droplegul<sup>UL</sup> is provided in the article. Two hydraulic flood nozzles Lechler 684.356.30X, mounted in a special holder TwinSprayCap were examined: pneumohydraulic twin flat spray air-injector nozzle Lechler DF 120-03 and hydraulic twin flat spray nozzle Lechler DF 120-02. A transverse repartition and a process of the formation of fluid drops, sprayed using different nozzles were examined. The results revealed that while spraying with a lower working pressure (e.g. 1.5 bar) with two hydraulic flood nozzles Lechler 684.356.30X that are placed in a special holder TwinSprayCap and embedded on a device Lechler Droplegul<sup>UL</sup>, a majority of drops (evenly around 40 ml) get into stand trays that are in a setting place situated 70 – 110 cm behind the device Lechler Droplegul<sup>UL</sup>, whereas at the approximate 40 cm area away from the

setting place there are no drops of sprayed fluid at all. Having the working pressure increased to 3 – 4 bar, majority of drops (around 60 ml) get into the stend trays that are in a setting place situated 70 – 110 cm behind the device Lechler Dropleg<sup>UL</sup>. Having the working pressure increased, an unsprayed area, which is situated around the setting place of the device Lechler Dropleg<sup>UL</sup>, gets narrowed: a width of unsprayed area when spraying at the pressure of 2 bar was around 60 cm, whereas when the pressure was 3 bar and 4 bar, the area appeared to be only 20 cm. Circularly sprayed drops, depending on the working pressure, spread around in two strips of width from 1.4 to 1.8 m. An oblong flat flow of the sprayed fluid forms nearby the deflector and the maximum height of the rise of sprayed drops reaches 1.3 – 1.4 m.

**Keywords:** Special devices Lechler Dropleg<sup>UL</sup>, cross distribution of flood, nozzles.

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## Assessment of Properties of Coarse-Energy Plants

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### Abstract

In the world, fossil fuel resources are constantly decreasing and increasing energy use. This leads to wider use of biomass in various industrial areas. Also, for the production of heat and electricity. Depending on the situation of current market, much attention is being paid to increasing the potential of biomass and to ensure the needs of users. Recently, much attention is paid to non-food energy plants, which could be used in thermochemical conversion technologies. These plants must be well adapted to climatic conditions, to grow a high biomass yield, to possess high energy value, easy to use for biofuel production and low environmental impact. Having a high energy potential and promising plants for

cultivation in a changing climate conditions can be characterized and these plants: this is namely miscanthus (*Miscantus* spp.), mugwort (*Artemisia dubia* Wall.) and fiber hemp (*Cannabis sativa* L.).

The article summarizes long-standing biometric and thermal performance results on namely miscanthus (*Miscantus* spp.), mugwort (*Artemisia dubia* Wall.) and fiber hemp (*Cannabis sativa* L.). In Lithuania climate condition, it is possible to grow from 3.26 to 17.06 t/ha of dry biomass per year from the mentioned plants. The calorific value of biomass has a huge influence on assessment of energy potential from plants. After combustion of 1 kilogram of *Miscantus* spp., *Artemisia dubia* Wall. and *Cannabis sativa* L. biomass it stands out on average  $18.3 \pm 0.06$ ,  $18.5 \pm 0.66$  and  $17.43 \pm 0.06$  MJ of heat, respectively. An equally important property which assesses the suitability of biomass for biofuels is ash content. The average ash content of biomass from *Miscantus* spp. and *Artemisia dubia* Wall. was  $1.51 \pm 0.03$  % and  $2.69 \pm 0.33$  %, i.e. 2.22 times and 1.25 times lower than *Cannabis sativa* L.

**Keywords:** energy plants, *Miscantus* spp., *Artemisia dubia* Wall., *Cannabis sativa* L., biomass, assessment.

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## Effect of Solar Distillation by Scheffler Reflector on Essential Oil Composition of *Thymus Satureioides*

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### Abstract

Medicinal and aromatic plants “PAM” acquire great importance in the international market and occupy an alternative culinary and therapeutic importance. These are in general used as raw materials for the extraction of active substances or chemical precursors and mainly for the production of teas, homemade-remedies, fluid extracts and also powders of dried plants. The various applications of essential oils make it with enormous importance in industrial scale and trade. Hence, *Thymus satureioides* plant was chosen for its effects among them antiseptic, antispasmodic, tonic, antibacterial and anti-inflammatory. Specially, the essential oil has been used in flavouring industries, food preservation and aromatherapy purposes.

Essential oils are generally obtained in laboratory by various extraction techniques such as steam distillation, solvent extraction, water distillation, vacuum microwave distillation, maceration and expression or cold pressing. Hence, renewable energy exploitation plays a crucial role in reducing the industrialization cost and the environmental problems due to the use fossil fuels. Solar energy can be used to improve energy security and economic growth in industry. Promoting innovative solar concentrator can open new opportunity to small companies and rural development for the extraction of essential oils from aromatic plants. The purpose of our study is to evaluate the distillation of *Thymus satureioides* essential oil and to valorize the distillation process using renewable energy by the use of Scheffler reflector. Fresh aerial parts of *Thymus satureioides* in the full flowering stage were used. The Scheffler Reflector uses the same principle of traditional still “the steam distillation”. The distillation unit consists basically of four parts: furnace (heat source based on solar energy), distillation still, condenser, and oil separator. The influences of this distillation process on phenolic compounds were investigated in comparison with other usual distillation methods. The quality and quantity of phenolic content of the essential oil obtained by scheffler reflector was identified. The phenolic content

was identified by the Folin–Ciocalteu method. However, the phenolic compound of essential oil was characterized by gas chromatography coupled to mass spectroscopy (GC-MS) type GC-MS Trace (GC Ultra - ITQ900, ThermoScientific, USA). The compounds identification was performed by comparing their mass spectra with data bank and homemade library mass spectra built up from pure substances and components of known essential oils and MS literature data, and by co-injection with an authentic sample. Also the constituents of essential oils were identified based on their Kovats Index, calculated in relation to the retention time of a series of alkanes (C4–C28) as reference products. The efficiency and benefit of this process have been demonstrated

**Keywords:** Essential oil, phenolic compounds, distillation, scheffler

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## Optimal Wind/Solar Energy Mix for Residential Net Zero-Energy Buildings

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### Abstract

The article is concentrated on the energy storage problems arising from microgeneration in private households. The case study involves a small-scale wind and solar electricity production set in a net zero-energy building. Both the net zero-energy building and the microgeneration units are connected to an utility grid. The current article serves to confirm the hypothesis, that the self consumption is at its maximum with the annual 70%/30% wind and solar energy mix of in favor of the wind. The maximal self consumption at no additional energy storage in a net zero-energy building is studied as well. The produced and consumed energies are equal, which satisfies the requirements for a net zero-energy building with the utility grid acting as an energy buffer. The consumed energy is used to operate a heat pump, warming circulated air, keeping the air circulating, supplying non-shiftable loads (white goods, TV, lighting etc), the hot water is produced inside a heat pump. To express self consumption, we use the term of supply cover factor, which describes optimally the directly consumed energy in relationship to net consumption or production. In annual scale, the cover factors for a net zero-energy building are equal as the production and consumption are equal as well. The seasonal variations in self consumption are studied, too. The main result is that the annual maximal supply cover factor in a net zero-energy building is 0.375 with 70/30 wind/solar mix. Seasonally, the self consumption is at its maximum in summer when the supply cover factor becomes equal to 0.49.

**Keywords:** demand response, supply cover factor, load shifting, net zero-energy building, solar energy, wind energy

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## Adaptability Ballistic Model for Granular Manure Fertilizers Spreading

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### Abstract

The ballistic model adaptability for the granular manure fertilizers spreading is a key to investigate the most effective model to spread fertilizes and to find the most economic use of the organic fertilizers. This method is suggested to minimize the quantity of expensive and extremely time consuming experiments. The object of this research is to investigate if ballistic model can be used to optimize spreading of granular organic fertilizer from agricultural waste products.

The aim of the investigation is to check the adaptability of the ballistic model for granular manure fertilizers spreading. Granular organic fertilizers have different physical characteristics that is determined by the process of preparation. These physical characteristics of fertilizer can change the spreading characteristics and it is important that the ballistic model gives the opportunity to change these characteristics and check the most optimal fertilizers characteristics and way of the spreading.

The variance method was used to investigate issues around spreading of granular manure fertilizers. For the evaluation of the aerodynamic properties of the pallets were used test stand - classification K- 293, air flow meter Delta OHM DO 9847 and electronic scales IPC 3WP. The FEM pallets aerodynamic and ballistic models were created. The pellet aerodynamic properties model was created with the complement FlowSimulation program SOLIDWORKS software. 500 pallets were randomly chosen to be characterized and each measurement was repeated 5 times to get statistically meaningful results. After the analysis was completed and arithmetic averages were evaluated results showed that the diameter of the granular compost fertilizer was: Manure I  $5.28 \pm 0.8$  mm, Manure II  $4.75 \pm 0.12$  mm. The prevailing length of the pellets was: for Manure I was 10 to 12.5 mm and for Manure II was 5-7.5 mm. The results of investigation showed that most of the granules (60,1 %) were vacuumed at  $17.4 \text{ m s}^{-1}$  critical air velocity for larger diameter pellets Manure I. After the evaluation of results, it was established that the flow rate of granular manure fertilizers is influenced by the diameter of the pallet.

**Keywords:** ballistic model, granular fertilizers, manure, spreading

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## **Increasing Electricity Self-Consumption in Residential Buildings by Electricity-to-Heat Conversion and Storage**

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### **Abstract**

The current paper addresses energy storage issues in residential buildings with the objective of increasing direct consumption. The building, connected to an utility grid, is supplied by a micro wind turbine and PV panels. The utility grid itself acts as an energy buffer. Only nonshiftable loads (white goods, TV etc.) and electric water heating are taken into account. The studied configuration comprises two cascaded heating tanks, one of them preheating boiler. The annual electricity production of the micro wind turbine and PV panels is chosen to cover the hot water demand and nonshiftable loads inside the building with 70%/30% ratio in favour of the wind energy. During the experiments, the generation graphs' shaving levels vary between 0 and 100%, with peak energy diverted into a preheating boiler and the remaining part fed into the main tank. The proposed solution allows increasing locally consumed energy share, as the energy of stochastic peaks is stored and used on later demand. The locally consumed energy is expressed by the cover factor, its increase possibilities are studied in the current paper. Our calculation are proceed with 5- minute time series. Our algorithm follow the amount of heat energy in main tank and

preheating boiler, counted also energy amounts as taken and given to boilers. Some restrictions have by increasing cover factor. By highest levels needs to turn to attention, that then rising exhaust heat from preheating boiler. We take this allowed capacity as 10 % of annual boiler energy turnover. The presumed growth of the cover factor at preheating boiler capacity of 125 l instead of 80 l is at least 5%. The main tank volume stay the same.

**Keywords:** cover factor, demand response, domestic hot water, load shifting, solar energy, wind energy

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## **A Pilot Scale Mobile Unit for Dynamic Mathematical Model of Continuous Microalgae Processing Identification on-line**

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### **Abstract:**

A pilot scale mobile biomass digestion unit was constructed, which can be used for bioenergy production process investigation and dynamic mathematical models of continuous processes testing on-line in parallel with industrial equipment and environment.

The equipment consists of two independent bioreactors, isobaric gasholder and feeding pumps. It can be easily transferred from parallel to serial configuration to meet the needs of every experiment. Everything is mounted on a car trailer, so the unit can be moved to any industrial or agricultural site for carrying experiments on-line.

The unit is equipped with a paperless recorder for experimental data logging. The recorder controls the adjustable temperature in the bioreactors, independently for each, and the level in the gasholder. This enables semi-automatic functioning of the equipment, only periodical feed up of raw substrate is done manually. The mixers of the bioreactors are controlled by variable frequency drives, enabling the change of mixing intensity in every reactor.

The initial idea is testing of microalgae biomass processing, although it can successfully be used with any other energetic biomass – food industry waste, waste water sludge, animal farm dung wash, etc. The ideas, solutions and even some hardware equipment, as well, as automation and data acquisition system of this pilot model are transferred from earlier works of the authors in the field of experimental equipment construction.

**Keywords:** Mathematical model, bioreactor, micro - algae

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## **Possibilities to Use Fish Waste for Energy**

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### **Abstract**

Most of the fish caught is used in the food industry. About 40% of the fish weight comprises fish fillet, and secondary raw materials, such as the fish head, tail, fins, guts and bones can comprise up to 60% of the fish weight. The secondary raw materials can be used in food industry, agriculture, for pharmaceutical purposes, etc. Other, no less important way for usage of secondary raw fish, dead fish and fish farming sludge is the utilization of mentioned feedstocks for energy purposes, i.e. biofuels production.

The aim of this study is to investigate the use possibilities of fish oil, which being in the secondary fish materials is unsuitable for the usage in the pharmaceutical industry, for biodiesel production, and biomass left after oil extraction or non de-oiled fish biomass for biogas production. Besides, fish farming sludge as fraction of composite feedstock substratum was used in this study. The investigation of energy production from fish waste were performed using dried and wet feedstock.

The estimated oil content in fish biomass reached 40.4%. The results of study of fatty acids composition showed that fish oil contains high content of monounsaturated fatty acids. The major part of saturated fatty acids is palmitic acid (8.8%), monounsaturated and polyunsaturated are oleic (49.6%) and linoleic acids (9.42%).

During analysis of biogas production was estimated that from 1 g volatile solids of fish waste it is possible to get more than 1000 ml of biogas, containing more than 65% of methane and from fish farming sludge amount of biogas is app. 600 ml/gVS.

Compared with biomass of fish waste, fish farming sludge has a significantly lower dry matter content (app.0.3-4%). Such sludge also can be used for energy production, but in order to make existing equipment useful from economical point of view, it should be mixed with the other feedstock containing a much

larger quantity of dry matter or concentrate sludge before using for biogas production.

In conclusion, it should be noted that the use of fish waste for energy, it is possible to increase the potential of renewable energy sources, thereby extracting a double effect: the energy and environmental benefits.

**Keywords:** fish waste, fish farming sludge, biofuels

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## Effect of Temperature and Excess Air Ratio on Combustion Process of Mixtures of Erucic Rapeseed

**Adam Kupczyk, Karol Tucki**

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### Abstract

The paper presents results of investigations into diesel engine fuelled with high erucic acid rapeseed oil and its mixture with diesel, petrol and ethanol at different proportions. The study was performed in a chamber with constant volume depending on temperature and air pressure and the coefficient of excess air. The main purpose of performed tests was to determine the effect of various parameters on processes of spontaneous combustion and combustion of fuels. During the study basic parameters of combustion, e.g. auto-ignition delay, greatest pressure and contractual time were compared. Studies show that increased pressure injection improves combustion process for all test fuels, and injection pressure most strongly affect the combustion process of rapeseed oil and its mixtures with ethanol.

**Keywords:** combustion, erucic, excess air ratio, rapeseed, temperature

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## **Influence of The Manufacturing Technology Process on Properties of Rapeseed Oil**

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### **Abstract**

The article presents results of research regarding the possibility of changing the properties of rapeseed oil thanks to applying diverse press techniques. The main objective of the study was to determine the impact of press parameters and the process of its cleaning on performance and contents of fatty acids in order to get the best parameters of rapeseed oil for fuel purposes. To analyse the ecological diesel engine, analysis shows the results of the quantities of impurities (phosphorus compounds, iodine and water). The research was conducted for oil obtained from six varieties of rapeseed. The parameters of press techniques have a small impact on the contents of individual fatty acids. However, changes of the content of the chemical compounds are dependent on the press parameters to a large extent.

**Keywords:** chemical compounds, parameters, rapeseed oil

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## **Dielectric USB-Moisture Meter for Seeds of Agricultural Crops**

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### **Abstract**

Due to the closed state of modern technical developments caused by hard conditions of market competition, information for teaching students innovations on the best examples of engineering and designing thought is not available. This is one of the serious-minded reasons that reduces the engineering education effectiveness in the field of technical knowledge of modern agricultural production. The solution of this problem can be innovative scientific and technical developments conducted by scientists of engineering departments and adapted to practice-oriented teaching technologies. An example of the development of a moisture meter for seeds of agricultural crops on the world-famous microcontroller Arduino-based platform, oriented to mastering the foundations of real-time information technologies is considered in the article. The principle of the moisture meter operation is based on the most common method for measuring the humidity of seeds – dielectric technique. The classical algorithm of conversion: dielectric constant, capacitance, frequency, table transformations, temperature correction is given. The methods of software structural designing, incl. functionally-oriented techniques for realizing the functions of real-time information systems were used in research process. The hardware and software for solving such tasks as measuring the humidity of crop seeds, as well as studying microcontroller devices operating on the base of classical methods of measurement have been developed. This example can be used to solve other engineering and scientific problems in the field of agriculture, where capacitive sensors are used.

Realization of the open resources principal at all stages from the studying the physical processes that explain the essence of the phenomenon until the hardware and software implementation creates the conditions allowing students to form not only professional competences but also general cultural competencies in the field of self-development and continuous education. This

is very important for the development of intellectual resources of each nation, which today determine its prosperity to a greater extent than natural resources and capital.

**Keywords:** microcontroller, Arduino, capacitance, RC-generator, frequency, algorithm, program, calibration table.

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## **Biogas Production From Switchgrass: Issues of Energy Efficiency**

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Aleksandras Stulginskis University, Lithuania

### **Abstract**

Installation and generation of renewable energy sources is a very fast growing area in the world during the past decade due to the resources depletion and climate change. Growing interest in the use of biomass for energy purpose has created demand for high biomass yielding crops. Therefore, C4 grass species, such as switchgrass (*Panicum virgatum*), should become strategic agricultural crops. Switchgrass cultivation in Europe for bioenergy is new. Biogas production of switchgrass provides an outstanding opportunity to convert biomass into energy. The objective of this study is to examine possibilities of the biogas production from switchgrass silage and evaluate energy efficiency. The experiments were performed under mesophilic conditions (38±1oC) using AMPTS laboratory digesters. Grass was chopped to 3-5 mm just after

harvesting and ensiled in a 3 l jars for 120 days. After the evaluation of the biogas yield and energy conversion efficiency performance it was found that switchgrass biomass is suitable as raw material for the production of biogas. The biomethane yield of selected plants ranged from 189 to 243 l CH<sub>4</sub>/kg dry organic matter. The energy potential from switchgrass legume can reach 31,2 - 36,7 GJ/ha. Direct and indirect energy input for switchgrass biomass production was 5,53 - 5,71 GJ/ha and for biogas production – 6,1 GJ/ha. The energy efficiency factor for biogas production from switchgrass silage was in the range of 2.39 - 3.15.

**Keywords:** biomass, biogas, anaerobic digestion, switchgrass, energy efficiency

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## **Conversion to Biogas of Herbaceous Plants, Used for Oil Hydrocarbons Contaminated Soils Cleaning**

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Aleksandras Stulginskis University, Lithuania

### **Abstract**

Fossil fuel demand growth in and price fluctuation, depletion resources and supply monopolize, climate change is forcing the restructuring of energy and other industrial and transport area, seeking for renewable energy sources. Using phytoremedial methods in biomass engineering, there is a possibility to create a sustainable method of biomass growth in mid-low contaminated sites soil system. Main aim of the research was to assess the oil-contaminated soil treatment herbaceous plants and their subsequent use for biogas production in order to create a closed cleaning and plant biomass utilization cycle.

After the evaluation of the biogas yield and energy conversion efficiency performance it was found that all of the selected herbaceous plant biomass is suitable as raw material for the production of biogas. The biogas potential of selected plants ranged from 377.2 to 822.9 l/kg dry organic matter with an energy value ranging from 7.1 MJ/kg to 17.1 MJ/kg.

**Keywords:** biogas, herbaceous plants, oil hydrocarbons, phytoremediation.

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## **Device for Control of Humidity of Loose Materials in the Stream of the Substance**

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### **Abstract**

Improvement of the design of the sample preparation device for bulk materials during the flow control of their moisture content, based on the use of the vibrating process to stabilize the bulk density, will ensure continuity of the flow of bulk materials. The accuracy of humidity measurement will be increased by using dielectric metric methods due to the decrease in the through conductivity of loose materials, which is associated with the rupture of contact bridges between their particles in the vibrating mass. An analysis of the results of an experimental study of bulk materials in a vibrating state shows that the use of such a grain state is advisable for the following reasons. Firstly, at a constant vibration amplitude, the bulk density of the grain mass stabilizes, and secondly, it's through conductivity sharply decreases, which is explained by the ruptures of contact bridges between the particles in the vibrating fluid mass of bulk material. Combination of the process of vibration for the purpose of stabilizing

the bulk density of bulk material with its simultaneous transportation through the cavity of the vibration chamber is carried out in the device proposed by the authors. In order to ensure the stabilization of the bulk density of bulk material, a device has been new developed.

**Keywords:** bulk material, density, grain, hopper, moisture, primary converter.

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## **Augmentation of Self Electricity Consumprion by Seasonal Controlling of Heat Storage Cover Factors for Residential Buildings**

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Estonian University of Life Sciences, Estonia

### **Abstract**

The research objective is to increase the locally consumed energy by using two water boilers, aiming to shorten the breakeven periods of the renewable energy production devices. The shaved peaks from stochastic wind turbine and PV generation are fed into a preheating tank, the remaining excess power is fed into the main boiler. The produced and consumed energies are in balance. The observed time period was one year with averaging timestep 5 minutes. The



annual PV/wind energy production share is assumed to be 30 %:70 % in favour of the wind. We change heights of peak shavings by season. This gives us additional possibilities to increase renewable energy cover factors.

**Keywords:** Wind energy, solar energy, load shifting, cover factor, domestic hot water, demand response, peak shaving

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## Effects of Waste Management Changes in Poland - Towards Circular Economy

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### Abstract

Increasing demand for consumer goods causes more and more waste. In line with the principle of sustainable development, waste policy should aim at ensuring that waste produced has the least impact on the natural environment. One solution is to use a circular economy. According to this concept waste production should be minimized as much as possible. Therefore, action should be taken to enable all raw materials to "stay" in economy for as long as possible. Main goal of the article is defined as an assess of the changes in the generation and management of municipal waste before and after the amendment of the Clean House Act.

As the research tasks were adopted:

to present changes in waste management legal regulations,

- to indicate waste generation level in Poland,

- the origin of the waste,
- to analyse and evaluate changes in the field of waste recovery, recycling and reuse.

In this context there is an important question, how could we decrease production and consumption in order to generate lower quantity of waste or recycle them appropriately and use again.

After the entry into force of the law on the maintenance of cleanliness and order in municipalities, there was a decrease in a production of mixed waste. Between 2012-2016 there was an increase in the amount of municipal waste picked up selectively.

The amount of mixed waste recycled in 2016 has increased fourfold in comparison to 2012, and the amount of waste recycled has increased by 42 times.

**Keywords:** waste management, environment, circular economy

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## **Dynamic of Prices of Vegetables in Organic Farming System Lithuania Period 2014-2016**

**Daiva Šileikienė, Laima Česonienė, Aurelija Paulauskienė**  
Aleksandras Stulginskis University, Lithuania

### **Abstract**

Organic agriculture is practiced in 172 countries, and 43.7 million hectares of agricultural land are managed organically by approximately 2.3 million farmers. The global sales of organic food and drink reached 80 billion US dollars in 2014. Organic vegetables are increasingly becoming popular and more in demand in Lithuania. Increased consumer needs to use more organic products made organic farms to develop more rapidly. Farmers undertake to produce and supply products to consumers, which corresponds to the year 2007, Council Regulation (EC) No 834/2007, and in 2008, Commission Regulation (EC) No 889/2008, which lays down detailed organic production and labelling of organic products on the implementation of the rules on organic production, labelling

and control. Consumers who choose high quality organic products sustain the environment and save its resources. Dynamic in prices organic potatoes, carrots, cabbage, onion prices is significantly different from the conventional. Analysis of the sales prices of the organic vegetables during the considered period is higher. Consistently, findings of the thesis indicate that the sales prices of the organic vegetables are higher than those of the imported. There is made comparative analysis of prices of organic and conventional vegetables (carrots, cabbages, onions) also performed comparative price analysis of imported and Lithuanian vegetables. Made price fluctuation assessment of organic potatoes and vegetables. Studies show that imported organic vegetable and potato prices are higher than Lithuanian. The smallest price differences between organic and conventional cabbage, maximum - between different agricultural production of onions and carrots.

**Keywords:** organic production, potatoes and vegetables, import, prices.

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## Research on the Development of the Tractor and Combine Fleet in Latvia

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### Abstract

The article offers an analysis of the development of the tractor and combine harvester fleet in 2001 - 2016. There are stated tractors and combines of the most common brands registered in the country. A methodology has been developed for the estimation of an adequate quantity of tractors and combines for timely cultivation of the sowing areas under agricultural crops. The

methodology is based on the calculation of the annual increase in the summary engine capacity of the entire fleet of tractors and combine harvesters, and its comparison with the annual increase in the sowing areas. It is assumed that 10% of the sowing areas are cultivated by worn-out tractors, and 7.5% of the new tractor and combine capacity is required for the replacement (amortisation) of the worn-out tractors. We consider that the increase in the summary capacity should compensate for the increase in the sowing areas, taking into account also the impact of the total yield upon the productivity of the machinery. It has been found out that during the period the summary engine capacity of the tractors has grown 1.52 times, the summary engine capacity of the combine harvesters – 2.8 times; in the same period the area under agricultural crops has increased approximately 1.38 times but the area under cereals and canola – approximately 1.8 times. Several authors consider specific capacity  $\text{kWh}^{-1}$  as a criterion for the estimation of an adequate quantity of the machinery; therefore there are calculated also its changes in a 16-year period, with the specific capacity of both the tractors and combine harvesters increasing. The average specific power  $\text{kWh}^{-1}$  is considered as relatively high, but, due to the concentration of production, a decrease in this indicator is possible in the future. The average weighted capacity of the purchased new tractors and combine harvesters has also increased. The increase in the summary capacity of the tractor fleet compensates for the increase in the sowing areas and even exceeds it a little. In its turn, the increase in the summary capacity of the combine fleet allows timely harvesting the significantly increased sowing area, and more than twice the increased totals yield at the end of the period, and, compared to the beginning, slightly shorten the harvesting duration. The calculations do not include weather conditions during the harvesting period. As increase in the sowing areas and total yield is expected still further, upgrading of the tractor fleet should be continued at approximately the same rate – by purchasing, on the average, 600 to 700 new tractors and 80 to 100 new combine harvesters every year.

**Key words:** fleet of tractors and grain combine harvesters, engine capacity, sown area

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## The Impact of Environmental Prevention Measures for Quality of Fresh Vegetables

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### Abstract

In recent years, there is an increase in consumption of food products and the supply of fresh vegetables to the consumer is getting more and more popular. However, this group of products is among the fastest perishing products. It is because of environmental and internal factors in vegetables during storage are unavoidable.

During the preparation for the market vegetables are being cleaned, washed, sanded, sorted and dried. This consumes a lot of energy and water. Different technological measures are used to reduce the consumption of natural resources during the preparation of products for the market and to slow down their quality changes. Ozone is an effective measure to slow down product biodestruction.

Ozone usage in small doses as a disinfectant is recognized as safe. Although there are a lot of publications in the usage of ozone, but its impact on vegetable qualitative indicators has not been sufficiently investigated. There is a lack of research in the analysis of the effects of ozonated water, which can be successfully used in vegetable washing technologies.

The article analyzes the effect of ozonated water treatment on fresh carrots color and quantity of carotenoids. The obtained data showed that the use of ozonated water in concentration of  $1.53 \pm 0.09 \text{ mg L}^{-1}$  did not have an affect on the amount carotenoids accumulated in the products. Also ozonated water did not have significant affect on the color of products.

**Keywords:** Ozonized water, vegetables surface, quality, color, carotenoids.

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## **A New Separation System for the By-Product of the Bast Fibre Production**

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### **Abstract**

Optimisation in cultivation and harvesting technologies as well as modern processing facilities are needed for farmers to play an important role as a reliable supplier of fibre materials at competitive prices. Efficient technologies has been developed and established in industry for fibre straw preparation, decortication and fibre cleaning in several countries during the last 15 years. For reliable and economic plant operation at this industrial level fibres and shives have to fulfil high quality standards. At present, there is still a substantial need for efficient shive processing and cleaning technologies. Cleaned high quality hemp shives can be used not only for animal bedding, but also for particle board or composite production.

Experimental investigations and results

Different novel shive cleaning techniques has been investigated during the last 5 years under laboratory conditions at the ATB as well as under industrial conditions in a pilot plant. The objective of this study was to develop a flexible fractionating and cleaning system for shives. General requirements for such a machine system are:

- high throughput (> 2 t/h)
- reliable operation also at varying quality of the input material
- adjustable cleaning degree for the shives (dust content, fibre content)
- efficient recovering of quality fibres for the shives
- fractionation of the shives in different particle size classes (if necessary for shive application)

A two-stage axial fractionator working with the principle of a paddle auger was developed and implemented in a pilot processing plant. The input material - a mixture of shives, fibres and dust – can be cleaned and classified into five end products:

- two particle size fractions of shives (coarse and fine shives)

- recovered long fibres (2 ... 10 cm length, dust free)
- fibre shive mixture (not completely decorticated materials)
- dust

On the basis of these results, the fractionating system has been patented and is scaled up to an industrial system in cooperation with a machine supplier for hemp processing equipment. Latest results of the investigations regarding efficient shive cleaning will be shown in the presentation.

**Key words:** *shives, separation, cleaning, hemp, fibres*

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## Overview About Harvesting Procedures for Industrial Hemp in Northern Europe

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### Abstract

A multitude of different harvesting procedures is available after the re-approval of hemp growing in Germany about 20 years ago. Established, but as well recent machine developments enable the supply of raw materials for further processing or as food and feed materials. In this study, harvesting procedures and technologies are analyzed that are currently used under Northern European cultivation conditions. The paper distinguishes between (a) harvesting systems for exclusive stem utilization, (b) harvesting systems for dual purposes and (c) harvesting systems for whole crop utilization. The harvesting systems are compared on the bases of the criteria working width, working speed, working time and procedural costs per hectare. Resulting from this, it can be seen that the necessary specialization level results in high but, compared to other established crops, not exceeding procedural costs. However, technological enhancements are still needed in order to improve the competitiveness of fibre hemp in the crop rotation as well as of hemp-based semi-finished and finished products..

**Keywords:** *Fibre hemp, harvest, procedures, technologies, assessment*

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## **The Estimation of the Structural Elements of Conductivity of the Vacuum System of a Portable Milking Machine**

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### **Abstract**

When designing the structural and functional schemes of the vacuum systems of a portable milking machine it is important to conduct a research on the impact on the milking machine efficiency. The technological efficiency and the regime of a vacuum system functioning are the basis of the research. The unstable pressure may cause the decrease in animals productivity and may have negative impact on cows welfare. That is why it is necessary to determine some rational parameters and choose the linking vacuum system decisions. It will result in getting stable working regimes of a portable milking machine. A research on the effects of different components variants as well as of vacuum system parameters on the consistency of operation has been conducted. The results of the research made it possible to estimate the impact of vacuum pump fast reaction as well as the vacuum system parameters on the job stability. It has been proved that the vacuum system efficiency is determined by the level of its conductivity. The conductivity is the inverse value to the vacuum system resistance. The research has determined how the vacuum system packaging affects the pressure loses. A mathematic model which enables to find the rational volume of a vacuum pump and determine the vacuum system conductivity has been received. On the results of the experimental research the vacuum system rational structure has been substantiated and estimated on a special efficiency coefficient.



**Keywords:** *packaging, efficiency coefficient, gob stability, structural and functional scheme.*

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## **Experimental Study of Brackish Water Distillation in Single Slope Solar Still Using Sensible Heat Storage Materials**

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### **Abstract:**

Solar distillation is one of the important methods of getting clean water from brackish and seawater using the renewable energy of the sun. The passive type solar still represent most economical method to supply drinking water for domestic applications for decentralized level. Experimental measurements of solar distillation productivity for single slope still were conducted at the testing field of the Mechanical Engineering department, Coimbatore Institute of Engineering and Technology, Coimbatore, Tamilnadu, India. The influence of basin water quantity and amount of energy storage materials are examined and the performance is compared. The target of this research is to find best way to keep the excess heat by energy storage materials and release it during off-sunshine hours for increment in distillate output and efficiency. Various

sensible heat energy storage materials like pebbles, blue metal stone, red brick, granites and white marbles were used as energy storage medium. The daily yield of black granite still is higher than other energy storage material stills and is equal to 3.216 kg/day/m<sup>2</sup>, which is 29% higher than that of the still without energy storage materials.

**Key words:** fresh water, passive still, solar distillation, energy storage material.

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## The Regime of Cowshed Environment and Ground Soils Temperature

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### Abstract

One of the ways to reduce the uses of heat and electricity energy in agricultural buildings and to improve microclimate is the increasing of heat isolation of the building and using effective building materials for constructions of barrier. It has been known that between outdoors and soil (that is in structure's zone) and between the lodgment's air, intense heat interchanges are through the floors to the soil as well as through foundations. These interchanges have a huge influence on the microclimate of the whole building. When microclimate is optimal, the animal efficiency may grow up to 30%. When microclimate is

incorrect, 15-20% of animals (especially young ones) could be lost because of diseases, their weight decreases to 25% and 15-20% of the feed is overdrift. The microclimate of the cowshed depends on building constructions, the temperature state of the building, the temperature of inside surfaces of barriers very much.

The influence of the ground soils below the cowshed building over the temperature regime of the traditional floor surface is analyzed in the study. Three borings for temperature measurements have been arranged outside and in the inside room of the building. Temperature variation curves (for various seasons) of the ground surface at the floor level of cowshed building have been made. The investigation of temperature variation of period one year at floor surface has been carried out. The character of variation of outside temperature (during the whole year) for the base of cowshed building and soils in its surroundings was produced.

Experimental temperature measurement data shows that a significant influence on the internal base ground temperature field has - heat radiated by animals, that attaches itself not only in the air, but also to the base ground through bearing housing floor. Particularly intense heat exchange between the outside air and ground-based cowshed through the foundation was noticed during the coldest time of the year. The outside air temperature falling below zero has reduced the ground temperature on the inner side of the base.

**Keywords:** *cowshed environment, soil, temperature*

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## The Analysis of Cracks in Beams of Quay No. 80A at Klaipeda Passenger and Cargo Terminal

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### Abstract

The cracks can be technological, appear during the usage time of construction, they can also be regular, and appear under the design load or they can also be unexpected and appear due to accidental impacts. Our research has shown that the cracks have appeared in reinforced concrete beams of the superstructure in quays No. 80 and 81 after the construction of Klaipeda Passenger and cargo terminal are caused by shrinkage strain, when the reinforced concrete beams has hardened. Normal hardening concrete shrinkage deformation is inevitable, but it depends on a number of factors, in particular, that in the present structures occurred because:

- W/C ratio of concrete mixture exceeds the allowable values;
- coarseness of selected aggregates ( $D = 16$  mm) are too small for the construction of a massive wall;
- concrete stratification and possible lack of care for hardening concrete (ambient temperature, etc.), this segregation could be affected by too big spread of concrete mixture (class of slump S3).

The crack width at reinforced concrete beams in the superstructure of quay No.80 varies from 0.05 to 0.5 mm. This are a non-structural cracks, so they do not reduce significantly the mechanical strength and stability of the structure. Also, research has shown that the relationship between the crack width and the distance between the cracks is weak. Proposals for elimination of potential causes of cracking are presented according to the results.

**Keywords:** quays, concrete shrinkage, cracks

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## **Economic Evaluation of Conventional Intensive and Precision Farming Technologies**

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### **Abstract**

In Lithuania, besides the usual farming technologies, starting precision agriculture (PA). The basic principle of the PA is to focus technological operations on the conditions located in separate field locations. When there in separate fields is a significant difference in the amount of nutrients in the soil, the distribution of weeds or diseases, then the crop fertilization and maintenance operations must be precisely adapted to these differences. Most importantly, these differences in soil and crops can be captured and converted into correspondingly differentiated instructions for agricultural machinery. This ensures the timely use of appropriate material resources, helps to optimize yields at the lowest cost, reduce environmental pollution and increase economic returns.

The purpose of this study is to perform a comparative analysis of economic indicators for summer wheat cultivation by using a usual intensive and PA technologies, and to determine the financial effect.

Economic indicators of summer wheat cultivation by using conventional intensive and precision farming (PA) technologies was determined, i.e. additional cost-benefit effect was calculated and the financial effect generated. Underlying research shows that better economic indicators are obtained through the using of PA technology. It was determined that the cost of mineral fertilizers during spring wheat cultivation in accordance with the PA technology was

lower in the two analyzed years and slightly higher in one year than the conventional intensive agricultural technology. The decline in fertilizer costs also led to a decrease in yield, which resulted in less incomes for one year from precision farming than the use of conventional intensive agricultural technology, and received a negative financial effect. In the other two years of analysis, additional revenues from spring wheat cultivation with PA technology exceeded the additional costs related with this technology and received a positive financial effect.

**Key words:** Conventional and precision agriculture, spring wheat, economic evaluation, financial effect.

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## Evaluation of Suitability to Use Plastic Waste in Concrete Production

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**Abstract:** Nowadays one of the main tasks of environmental protection is the management and recycling of plastic waste. Plastic occupy the major part of all public waste and with this material is polluted all earth. In natural condition plastic decompose in 400 or even in 500 years. Therefore, it is important to solve this problem reusing plastic waste. One of the possible areas is construction industry. In the present paper were estimated how plastic waste impact the properties of concrete. During the research the part of coarse aggregates were changed with polyethylene (PE) pellets and cut polypropylene (PP) particles. The change of fresh concrete density, workability and hardened

concrete density, compression strength, water absorbability were evaluated. The results show, that plastic waste has a positive effect on fresh concrete properties: the concrete become more workable and lighter. Unfortunately, on the main hardened concrete properties the increase plastic waste amount has the negative effect: the compression strength was decreasing and the water absorbability was increasing. However, generalizing all results it is can be stated, that keeping the same level of concrete workability there possibilities to reduce water and cement ratio and it will give strength loss and water absorbability growth compensation.

**Keywords:** plastic waste, concrete, aggregates, workability, compression strength, water absorbability.

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## The Influence of Tractor Fleet Growth on Environmental Pollution

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### Abstract

The article consists of 4 pages which contain theoretical calculations of gas emissions with regard to the growth of tractor fleet and distinguish the main segment (tractors in the 37-75 kW engine power class).

Tractors are the main power supply in agriculture, therefore the increase in pollution is influenced by the rise of the number of tractors and other fleets of agricultural vehicles. Nowadays, machinery manufacturers and their users are forced to reduce fuel consumption and emission by environmental

requirements. The greatest attention in the field of emission reduction is paid to carbon monoxide (CO), nitrogen oxide (NO), unburned hydrocarbon (HC), soot (PM).

Based on the data of the register of tractors, self-propelled and agricultural vehicles and their trailers, 143 480 tractors are registered in Lithuania, 81.0 per cent of which are tractors whose power does not exceed 75 kW. Tractors made by Eastern European manufacturers constitute as much as 37 per cent of tractor fleet, which although being popular for their competitive price, use more fuel to produce one kilowatt hour of energy than the Western models in the same power category. High comparative efficient fuel consumption results in considerable losses, high smoke and noxious gas emissions. Tractor power and engine efficiency have the greatest influence on fuel consumption and oxide emissions. Having carried out the theoretical calculations of oxide emissions of tractors in the 37-75 kW engine power class, it can be stated that the amount of carbon monoxide (CO) amounts to 0.63 tons per year, while particulate matter (PM) constitutes up to 0.02 tons per year. New reinvented tractors are subject to particularly strict Tier / Stage IV gas emission reduction regulations, however such tractors constitute a minor share on the overall tractor market. Therefore, investments into the purchase of new tractors would contribute to the reduction of environmental pollution, soil conservation and retaining of friendlier environment.

**Keywords:** tractor, air pollution, emission

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## Analysis of Alternative Energy Sources and Their Use in the Pig Breeding Farm During the Winter Period

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### Abstract

Investigations were carried out at the pig breeding farm located in Šalčininkai district. There are 9 halls in the pig farm, two of which are dedicated to pig breeding. One barn was reconstructed: installed heated-cooled floor with the heat pump and a manure-slurry cooling system. The second barn was installed more than 50 years ago and has not been modernized yet. This hall doesn't have mechanical cooling system and it is heated by a gas heater, infrared rays are installed in the pig holders. Both barns have a mechanical air exhaust system. The research data were collected during the winter season. Also was collected statistical data on the birth rate, weight gain, morbidity and piglets' death. The parameters of the old barn microclimate depended directly on outdoor air parameters. The average temperature in the old housing was 21 °C, in the modernized 27 °C; humidity was 79% and 54% respectively. In the winter period, in the old barn, due to low air temperatures and high humidity, the piglets' death was 7.8% upper and the weight gain of 35% lower than in the reconstructed barn. It has been determined that the microclimate parameters influence the growth of the weight of piglets, their fall, and morbidity. The installed heated-cooled floor and manure-slurry cooling systems allow the farm to not use other types of fuel, facilitate the maintenance of the microclimate parameters of the barn (maintenance of the design temperature all the year), reduce emissions of CO<sub>2</sub> and NH<sub>3</sub> into the environment, and receive higher revenues from growing and selling products.

**Keywords:** manure-slurry cooling system, microclimate, heat pump, livestock farm, pigs breeding, piglets weight gain.

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## **Comparison of Water Heating by Solar Collectors and Photovoltaic Panels**

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### **Abstract**

The amount of presently mainly used fossil energy resources on the earth are limited and its impact on the earth environment is negative. Therefore, scientific research on replacing them with alternative energy like solar energy is important. In Latvia, with other sources of energy solar radiation energy in summer time for domestic water heating by solar collectors is used. Only for specific cases, it has used for production on electricity. Our many years research on the problem has showed that at certain conditions electricity, produced by solar photovoltaic (PV) panels, can used for domestic water heating also. The aim of the research is to make out the more preferable method and means for water heating by solar radiation particularly in weather conditions of Latvia. The research has shown that, at the same intensity of solar radiation, air temperature and relative humidity, speed of wind and other conditions, the efficiency of solar collectors at domestic water heating is considerably higher than of PV panels. The efficiency of both solar collectors and panels is higher, if heated water has consumed continuously at the same time of heating in order to avoid heat losses. For solar collectors the efficiency is higher at bigger difference between the heat transfer medium temperature and water temperature in the hot water tank of the heating device, and at higher ambient air temperature. Solar collectors have heat inertia, which lowers its efficiency at changing solar radiation intensity. The construction of solar collectors is more complicated, than of solar panels and its cost is higher. The efficiency of PV panels is higher at lower ambient air temperature. They do not have heat inertia and heat water independently of its temperature. For water heating by electricity, electric resistance heaters have be used. Water heating by electricity using solar panels in Latvia is preferable in spring and autumn months, when the air temperature is low bet solar radiation intensity is high enough. The methods of investigation corresponds to the goal of investigation – to analyze the effectivity of solar collectors and solar panels designed, produced and used in Ulbroka Research Centre.

**Keywords:** photovoltaic panels, solar collectors, solar radiation, water heating.

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## **Fattening and Slaughter Results Analysis of Hereford breed Bulls Born in Different Seasons**

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### **Abstract**

The aim of this study was to explain the birth season effect on Hereford bulls fattening results. The research was made within the project 'Baltic Grassland Beef' framework in years 2015 and 2016. Data about 41 Herford purebred bull was used in the research, grown in different farms of Latvia. Bulls were slaughtered in certified slaughterhouse 'Agaras' (Lithuania). The average birth weight of the Hereford breed bulls was in border from 42.9 – 45.0 kg. The lowest birth weight was on spring season born bulls – 42.9 kg, but the highest on winter season born bulls - 45.0. Average realization age of bull's, in the research groups, was on range from 567 days to 661 days. Bulls born on autumn and winter before slaughtering were significantly older, respectively 661 and 655 days with live weight of 519.9 kg un 542.1 kg. On spring born bulls with age 600 days reached the biggest live weight – 542.0 kg, respectively these group bulls average daily weight gain from birth to slaughter per day was the biggest among all the groups – 831.9 g. The highest slaughter weight showed on autumn and winter seasons born bulls, respectively 275.5 kg and 274.8 kg. In the research groups on different seasons born bulls conformation score was from points 2.4 to 2.6. All the bull's carcass in the research groups were

evaluated as 2nd and 3rd fat class. between the age before slaughter and average daily weight gain from birth to slaughter there is an important negative correlation (from  $r = -0.858$  to  $-0.977$ ,  $p < 0.05$ ), except on spring season born bulls.

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## Determination of Dependence of Wood Biomass Disintegration Parameters on Water Content

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### Abstract

Mechanical properties of wood are an important aspect in its processing. Wood is traditionally used for construction and technical purposes. Recently, its importance has grown in energy use. For energy use, it is necessary to modify the wood dimensionally into the desired shape. Therefore, the disintegration is an important operation in wood processing. Its difficulty depends on the properties of the wood.

The authors have determined the parameters of energy-using wood species on a water content in the range of 0-50%. The observed properties were wood shear stress. With decreasing water content, the shear stress of wood decreases. The shear strength limit of poplar wood increased from 22.3 MPa to 30.2 MPa. Poplar samples had a higher shear strength than willow samples.

**Keywords:** renewable energy, energy biomass, shear stress, shear strength, chipping, disintegration, poplar, willow, wood properties

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## Reduction of Ammonia Emissions from Cattle Manure Using Biopreparations

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### Abstract

Experimental studies performed at the laboratory enabled to find out the effect of the biopreparation on the process of ammonia volatilization from manure. Adding biopreparation to manure was found to slow down ammonia emission from manure. Depending on the manure composition, temperature of the environment, and duration of exposure to the biopreparation, the emission was found to decrease by up to 22%. The maximum effect was observed on the day 6–14, whereas 30 days after biopreparation's use its effect was significantly decreased. The effect of biopreparation on ammonia volatilization was observed to be higher under more intensive ammonia emissions, i.e. when the manure was fresh, with no crust formed on its surface, under high air flow velocity above the manure and high ammonia concentration gradient in the surface of the manure. Use of the biopreparation is highly recommended for reduction of ammonia emissions in litter-free barns where liquid manure accumulates. Its use is consistent with the modernization tendencies to implement litter-free liquid manure technologies. The effect of the biopreparation was found to be more pronounced in summer time.

**Keywords:** *NH<sub>3</sub> emissions, manure, cowsheds, biopreparations*

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## Influence of Cylinder Design on its Speed During Corn Ear Threshing

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### Abstract

Technological and structural parameters of a threshing unit must ensure the highest possible quality of its operation under minimum input and cost. The aim of the study was to estimate the variation of speed of threshing cylinder with two different shapes of filler plates (FP-I and FP-II) under various corn ear feed rate into combine harvester.

Threshing cylinder speed (frequency of rotation)  $n_b$  ( $\text{min}^{-1}$ ) was measured simultaneously each 0.075 s using stationary tangential single-cylinder threshing unit located in laboratory-training ground intended for investigation into technological processes of agricultural machinery. Frequency of rotation of non-loaded threshing cylinder speed amounted for  $450 \text{ min}^{-1}$ .

Increase in corn ear feed rate from  $6 \text{ kg s}^{-1}$  to  $12 \text{ kg s}^{-1}$  caused frequency of rotation of threshing cylinder to decrease from  $n_b=437.82\pm 0.21 \text{ min}^{-1}$  to  $n_b=420.96\pm 0.50 \text{ min}^{-1}$  (using FP-I). Replacing covered spaces between rasp bars with FP-II had no effect on cylinder speed – it has decreased from  $438.06\pm 0.23 \text{ min}^{-1}$  to  $421.37\pm 0.32 \text{ min}^{-1}$ . Results showed that in case of FP-I, the amplitude of speed  $A_{nb}$  has increased from  $A_{nb}=4.07\pm 0.44 \text{ min}^{-1}$  to  $A_{nb}=8.60\pm 0.88 \text{ min}^{-1}$ , whereas in case of FP-II – from  $A_{nb}=2.67\pm 0.25 \text{ min}^{-1}$  to  $A_{nb}=4.52\pm 0.62 \text{ min}^{-1}$  in response to increased feed rate from  $4 \text{ kg s}^{-1}$  to  $12 \text{ kg s}^{-1}$ . This means that using the covers FP-II the threshing apparatus will work more evenly. The average threshing cylinder speed, irrespective of the closure of spaces between rasp bars, was found to decrease by approx.  $20 \text{ min}^{-1}$  in result of increase in corn ear feed rate from  $4 \text{ kg s}^{-1}$  to  $12 \text{ kg s}^{-1}$ . When threshing corn ears, irrespective of the shape of filler plates, the acceptable feed rate amounted for  $10 \text{ kg s}^{-1}$ , as it caused to exceed the permissible limit of 5% allowed for decrease in cylinder speed ( $n_b=427.5 \text{ min}^{-1}$ ).

**Keywords:** *concave, corn ear, feed rate, threshing cylinder.*

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## **Influence of Working Speed of Power Harrow on Soil Particles Translocation**

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### **Abstract**

Displacement of soil particles by erosion can be seen as a major threat to the quality of agricultural land in the conditions of Czech Republic. While the effects of water and wind erosion have long been investigated and reported, the effect of soil tillage technology on soil particles translocation are relatively new area of agriculture research. Soil tillage may contribute to the undesirable translocation of soil particles towards lower-lying parts of fields especially on slopes. The effect of soil tillage implements on soil particle translocation has not been sufficiently explained yet. The object of this research was to assess the influence of different operating speed of power harrow on soil particle translocation during secondary tillage (soil preparation). Measurements to determine the displacement of soil particles were performed in location Nesperská Lhota in the Central Bohemia Region. Measurements were performed on a sandy loam cambisol after harvest spring cereals (oat for silage production). To indicate displacement of soil particles was used grit of white

limestone (size 10-16 mm). Limestone was put down into the trench with known position orthogonal to the direction of working operations. Subsequently were performed working operations in the specified sequence. Limestone particles were counted and weighed in each section. It was detected by measuring the different nature of displacement. Statistical significance of differences in the weight of translocated particles was evaluated for different operating speeds of tpower harrow from 4.5 to 12 km.h-1.

**Keywords:** tillage erosion, soil tillage, working speed

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## Evaluation of Combine Harvesters Fleet Management

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### Abstract

Combine harvesters play a crucial role in grain harvest. Due to seasonal character of work of these machines is necessary to achieve high standard in durability and reliability during working period. There is lots of requirements that have to be done according to the crop type, field conditions and as well as high performance and lower costs. Combine harvesters are the main harvesting technology of cereals in the world and main piece of work should be done in short time. The aim of this paper is an economic analysis of combine harvester's fleet in different working conditions. The evaluation is based on exact costs analysis of combine harvesters New Holland brand sort by different ages and different concepts of threshing. Used data were collected during all working seasons of combines. There is a data set from 10 seasons. There is two groups in evaluation - 8 machines NH CR 9080 and another 8 machines NH CX 8080. Working parameters evaluated are fuel consumption and operational costs. Thanks to on board computer we have data about performance of each machine per day and per whole season. Costs are calculated as fixed and variable and then summarized for every machine. The result shows that effect of costs analysis depends on annual performance of the machine. There is positive effect



on depressing fixed cost due to higher performance in season. A special result of this study is evidence of intervenes reason during all seasons and setting up the coefficient of repairs for the group of combines.

**Keywords:** combine harvester, cost, performance

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## **Role of renewable energy sector in specific European Union states, with particular focus on Poland**

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### **Abstract**

At present, the energy from renewable sources is an important element of the sustainable development strategy of the European Union (strategy covering the period until 2020). The article presents the role of renewable energy in the structure of primary energy sources and total energy production. In order to evaluate the present-day role of the renewable energy sector, specific European Union states were analysed, with particular focus on Poland, the country whose results were juxtaposed with the average ratios established for the EU-28. A detailed analysis of the current facts was performed (also a forecast for the period running up to 2020 was made), where particular energy sources were distinguished in the renewable energy production structure. A special role among renewable energy sources was ascribed to solar energy, wind energy, hydropower, geothermal energy, biogases and biofuels. The conclusions drawn from the research point out to the fact that the development of renewable energy in Poland is growing slowly but surely. The projected directions of renewable

energy development indicate that this sector is going to be a significant factor in implementing the sustainable development policy in the years to come.

**Keywords:** European Union, Poland, renewable energy sector

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## **The Role of Irrigation in River Valleys to Develop Water Quality and Sustainable Rural Development – Case Study of Warta Tributary**

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### **Abstract**

Ner river and its valley for over 170 years has been receiver for sewages from the city of Łódź. The natural system of this region (on the border of the watershed location, limitations of water supplies sources, lack of bigger natural rivers) in connection to Łódź city growth, lead to formulation of specific system involving an agglomeration and water supplies system as well as sewage treatment system.

The Ner river valley (tributary Warta river) has the great potential to be effective in production biomass for energy purposes. Irrigation with polluted Ner river water would cover fast growing plants high water and nutritional requirements. This would also work for the improvement of Ner river water quality (the achievement of good quality of water is not possible without irrigation).

An amount of sewage discharged to Ner (approximately 193 000 m<sup>3</sup> per day ) several times higher then its natural flow and this is a result of strategy of water supply that is supported by transport of water from Pilica river and underground

water uptake. Relatively high runoff coefficient in years 1952 – 2011 was equal to 0.325 for Ner, in comparison to 0.17 for other rivers in Warta catchment.

Despite the low natural flow Ner river discharges annually relatively high contaminants' load to Warta river. In the analysed period (1995-2003) the annual average flow of Ner river amounted 10% of annual average Warta river flow below its estuary. The share of analysed indicators of contaminants' load approximated 27% for total nitrogen, 37% for phosphorus, 39% for BOD<sub>5</sub> and 28% for suspended solids.

In the period 2004-2011 the annual average flow of Ner river amounted 13.8% of annual average Warta river flow. The share of investigated pollutants loads consists 27.9% for total nitrogen, 42.6 % for phosphorus, 19.8 % for BOD<sub>5</sub> and 19.6 % 28% for suspended solids.

**Keywords:** water quality, load of pollutants, waste water treatment, border irrigation, biomass, energy plantation.

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## **Methods of Complex Assessment of Natural and Anthropogenic Pressure for Water Resources in Central Asia Conditions - Karatal River Case Study**

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### **Abstract**

Development of the national economy in the Karatal basin river is characterized by the progressive involvement and development of the resource potential of natural landscapes, the current rate of utilization of which greatly enhances the anthropogenic impact on the natural environment. A significant impact on the formation of the ecological environment of natural landscapes is provided by the rural and water sectors, as well as by industrial facilities related to processing and mining. At the same time, on the one hand the economic activity of the man in the catchment areas of the river basin gives a certain positive effect, and on the other hand, it is accompanied by an unavoidable set of

negative ecological consequences that complicate ecological situations in various ranks of natural systems. Such negative natural and man-caused process in human activity occurs as a result of inadequate knowledge of the regularities of interaction between natural and anthropogenic factors, about the processes developing in the natural environment in complex watershed management, which is one of the obstacles on the way to the creation of ecologically sustainable cost-effective water catchment systems.

Scientific interest to the assessment of the ecological state of the catchments of rivers and the problem of their complex development have been appeared relatively recently which is explained by the increase in modern conditions of anthropogenic load on the catchment areas, the need to assess the impact of such pressures on the ecological stability of catchments and the emergence of the problem of ensuring the sustainable function of catchments.

The object of the research is the catchment basin of the Karatal river with a length of 390 km, an area of 19.1 thousand km<sup>2</sup>, which is formed by the merger of three rivers called Tekeliaryk, Chadzha and Kora, sources which are at an altitude of 3200-3900 m. The initial 160 km is mountain character, from the Zhungarian Alatau and below the confluence of Kara and Chizhe River overlooks a wide intermountain plain. Other tributaries are Kara, Terekty, Laba, Balykty, Mokur and the most abundant is Koksus. After the confluence of the tributary of the Koksus River, Karatal flows through the sandy desert of the Southern Balkhash. At a distance of 40 km from the mouth, the river has a delta area of 860 km<sup>2</sup>. According to long-term observations, the average annual discharge of the Karatal River in the Ushtobe section is 66.7 m<sup>3</sup>/s or 2.1 km<sup>3</sup>/year.

**Keywords:** geomorphological analysis, indicators of anthropogenic loads, hydrological-climatic assessment, landscape melioration

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## **The Influence of Biological Additives on The Moisture Retention of Soil**

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### **Abstract**

With the onset of climate change, dry periods are more frequent, and therefore the rational use of naturally accumulating soil moisture can be a tool to regulate the unfavorable soil moisture regime. Demand for new biological materials is increasing rapidly with the development of biotechnological science. Superabsorbent or water retaining material is considered promising material that is widely used in the fields of industry and agriculture. These can both absorb large amounts of water, as much as hundreds of times their own mass. The use of biological environmentally friendly additives to the cultivation of agricultural products, particularly germination and rooting periods, can ensure the required moisture content of the soil. The use of additives is more economical growing relatively more expensive raw materials, so in most cases it is related to vegetable and berry crops. The aim is to investigate the extent to which biological additives can absorb and give back moisture, assessing the different incorporation relations, as well as different biological additives. Soil moisture change samples were assessed under laboratory conditions with these biological additives: Stockosorb<sup>®</sup>, agroperlite, vermiculite, as well as universal hydro-granules. Biological additives, in accordance with the manufacturers recommendations, were mixed with mineral soil mixture (substrate). Laboratory test conditions were also carried out by means of environmental chambers monitored 24 hours a day set at 17 °C, 19 °C, and 20 °C. Soil moisture variation for samples with embedded biological additives ended after 24 and 26 days under laboratory conditions at 17 and 19 °C; it ended after 15 days in an environmental chamber at 20 °C. On average, soil moisture retention increases by 14 days more than the control without additives. The results showed that at low temperatures all the biological additives considered help to keep the moisture available to the plants longer in the soil for approximately the same number of days. In assessing these results, it should be emphasized that the conditions in the nature are different from the simulated critical temperatures and without the addition of moisture, in the natural conditions the impact of biological additives will be longer.

**Keywords:** evaporation, soil moisture, biological additives

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## **Assessment of Organic and Natural Magnesium Mineral Fertilizers Granulation and Determination of Produced Pellet Properties**

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### **Abstract**

Research was carried out in Aleksandras Stulginskis University with the natural magnesium mineral fertilizer – magnesium silicate Serpentine rocks, which were grounded and granulated with impact granulation technology, organic cattle manure compost fertilizer, which was granulated by the granulator with a horizontal granulator matrix (diameter of pellets 6 mm), and the mixture of Serpentine and manure pellets (mixture ratio 1:1, diameter of pellets 6 mm). There were investigated and estimated the biometric and physical-mechanical properties of produced fertilizer granules – pellet granulometric composition and biometric indicators, moisture content, density and pellet strength (resistance to impact forces). Research results showed that pellet moisture content was sufficient low and varied from 4.7 % to 14.7 %, and produced pellet density was so big and reached more than 1000 kg m<sup>-3</sup> DM (dry matter). Results on resistance to deformation of investigated mineral magnesium and organic fertilizers indicate that the highest resistance is the granules made of Serpentine and manure pellets mixture, they decompose to 550.5 N force, granules of manure pellets (without Serpentine) disintegrate to about two times smaller

force – 271.4 N. The research results show that fertilizer granules made of organic manure and mixture with magnesium silicate Serpentine are of high quality, these granules are sufficient resistant to compression on a static force, these granules are convenient for storage, transportation and mechanical spreading in the field.

**Keywords:** organic fertilizers, manure, magnesium fertilizers, Serpentine, granules, properties, density, strength.

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## Lipids Accumulation of *Chlorella vulgaris* under Variable Lighting Conditions

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### Abstract

The cultivation of microalgae is now an intensively developed research area. Some species of microalgae under appropriate conditions accumulate large amounts of lipids in the cells, which may be a suitable feedstock for biodiesel production. The cultures of microalgae for lipids production should be cultivated in specific physicochemical conditions. The most important environmental parameters affecting the algae growth are: nutrients, lighting, reaction, turbulence, salinity and temperature. Periodic changes in lighting is a key parameter that have a significant effect on cells density and lipid accumulation. The mechanism of this action depends on intensity of light and its spectral composition. To produce 3<sup>rd</sup> and 4<sup>th</sup> generation biofuels, a better understanding of the relationship between light conditions and yield of lipids accumulation is necessary. The aim of the study was to determine the effects of variable lighting conditions for lipids accumulation of microalgae *Chlorella vulgaris* and to determine the most effective lighting parameters. The study confirmed the possibility of using the lighting shock conditions to maximize lipids accumulation in algae *Chlorella vulgaris* cells. In the study, 33.18% of lipids were obtained from biomass culturing with red light-emitting diodes (LEDs), which was 22% more than obtained with white continuous lighting.

**Key words:** microalgae, *chlorella vulgaris*, photobioreactors, lipids, light, biodiesel

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**MULTIFUNCTIONAL APPROACH FOR  
SUSTAINABLE USE OF BIO-RESOURCES**

## Developing Marketing Strategies for Food Diversity: a Case-Study in Northern Portugal

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### Abstract

Vale do Sousa is a heterogeneous territory located in the North Region of Portugal. The manufacturing industry currently employs around half the active population but, until a few decades ago, the economy was founded on small-scale farming with maize as one important crop. Maize was used to produce maize bread (*Broa*), following an ancient recipe of millet bread (*Borona*). Each community had its own maize varieties and practices, which were reflected in the composition, shape, size and flavour of local *Broa*. In the last decades, the abandonment of agriculture was noticeable, leading to a progressive decrease in maize production and to genetic erosion. The traditional knowledge of landraces selection and *Broa* production was neglected. More recently, local stakeholders became aware of the important role that landraces and biodiverse food can play in local development and have engaged in finding new opportunities for a sustainable *Broa* value chain development in Vale do Sousa region. This paper aims at identifying opportunities and bottlenecks in the marketing of regional *Broa*. It uses a case study approach, developed as part of European Project DIVERSIFOOD<sup>1</sup>, that covers the whole supply chain and includes needs and expectations of farmers, processors, consumers and their networks.

The main problem identified by local actors for the success of a marketing strategy for *Broa* is that traditional varieties are less productive, leading farmers to favour commercial maize varieties which produce higher yields but are less suitable for baking. At the processing level, local actors raised the question of legislation as one of the major threats for the process, arguing that, in Portugal, European rules on food safety are not realistically applied to endogenous food products. The results also show that final consumers as well as restaurants recognize the quality of traditional *Broa* and seem to be willing to pay a price premium to reward farmers for using traditional varieties in production.

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<sup>1</sup> The Diversifood project has received funding from the European Union's H2020 programme under Grant Agreement 633571.

**Keywords:** bread; landraces; maize; participatory research; local development

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## **The effect of solid manure incorporation into the soil on the emission of gases and odours**

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### **Abstract**

The aim of the study was to determine the level of emission reduction of harmful gases and odours by solid manure incorporation. The research was carried out at the Experimental Station of the National Research Institute of Animal Production, in the Kostkowice Farm, in September 2016. Two experimental plots size 6 x 100 m were located on corn stubble in the distance of 40 m.

In plot I, the solid manure was applied using the prototype device. The modular device incorporates solid manure into the soil. It was designed and made by Industrial Institute of Agricultural Engineering, as part of the BIOGAS & EE project. In Plot II, manure was applied by manure spreader. During the study the concentration of harmful gases (NH<sub>3</sub>, CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) and odours was measured. Measurements were made in the following periods: immediately after application and 2, 4, 6, 10 and 14 hours after application. The concentration of the studied pollutants was measured in the air sample taken at a height of 0.4 m above the experimental plot. Before sampling, the selected parts of experimental plots were covered with chamber from surface emission sources.

The concentration of studied gases was measured immediately after sampling by the photoacoustic spectrometer (Multi Gas Monitor Innova 1312). The odours concentration was determined within 30 hours after air sampling by dynamic olfactometry using the TO 8 olfactometer. The tests were made in

Laboratory of Agricultural Technology and Biosystems of the Institute of Technology and Life Sciences in Poznań. During the study, the selected weather parameters were also monitored. The air temperature and relative humidity were measured using the multifunction measuring instrument (Testo 435-4) with an accuracy of 0.3°C and 2%, respectively.

The solid manure incorporation reduced NH<sub>3</sub> emissions by an average of 39%. For the other studied gases the differences in concentration were too small or this concentration was close to concentration of these gases in surrounding air. The incorporation of solid manure limited also odour emissions. The level reduction decreased with time and amounted to an average of 24%.

**Keywords:** solid manure, fertilization, odour emission, ammonia emission

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## The Evaluation of the Compatibility of Cereal and Green Manure on the Basis of Nutrients

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### Abstract

Research was carried out at the Lithuanian Research Centre for Agriculture and Forestry's (LAMMC) Joniškėlis Experimental Station on a clay loam *Endocalcari Endohypogleyic Cambisol*. The study was aimed to explore the aboveground mass of perennial forage legumes: red clover (*Trifolium pratense* L.) and lucerne (*Medicago sativa* L.), and their mixtures with festulolium (x *Festulolium*), used as green manure, qualitative parameters and compatibility with cereals on the basis of nutrients (N, P, K). The mass of perennial forage

legumes and their mixtures with festulolium were rich with nitrogen. The deficiency of other nutrients (P, K) and intensity of green manure mineralization can lead to nitrogen absorption. It has been determined that winter wheat takes one kg of nitrogen together with 0.2 kg P and 0.6 kg K. Spring wheat requires a similar amount of P but a higher amount of K. Average winter wheat grain yield can be 4.0 t ha<sup>-1</sup> on a clay loam *Cambisol* in organic cropping system. NPK content – 134 kg ha<sup>-1</sup> is needed for such productivity (grain + straw). This content is lower 25 % for spring winter growing. P:N and K:N ratios are more favourable in perennial forage legume mixture with festulolium, as compared to legume alone. So this green manure is more value. According to results, to get 4.0 t ha<sup>-1</sup> winter wheat organic productions, we need the use 3.0 t ha<sup>-1</sup> of forage legume dry matter (DM) mass. The amount of perennial legumes and festulolium mixture used in fertilization should be increased. The amount of 2.0 t ha<sup>-1</sup> forage legumes mixtures with festulolium DM mass is sufficient for 3.0 t ha<sup>-1</sup> of spring cereal grain production.

**Keywords:** green mass, nitrogen, organic farming, phosphorus, potassium, yields of cereals.

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## Forest Regeneration Quality Assessment by ASTA System

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### Abstract

In Latvia one third is regenerated by planting and therefore it is important to choose appropriate soil preparation and right seedling combination for each forest type. Usually success of afforestation is evaluated by average seedling survival rate and growth parameters like height, annual increment and diameter

at breast height disregarding seedling location in stand but usually there is no entirely homogeneous environmental conditions in young stand on average. There is noticeable micro topography difference that has an impact on seedling growth, because it modifies water regime, temperature, micronutrient availability, sun radiation and other factors. Therefore, aim of this work is to improve monitoring methods of successful forest regeneration and determine the most efficient soil preparation and seedling combination. That could be done by ASTA documentation system originally developed to show seedling and mound location and density in planting area during mechanic planting. But it also allows to link seedling precise location and growing conditions with its growing rate and survival and that allow you to exclude these seedlings that is effected by other factors than those that you are interested in so you can gain more representative results, that can be used in forest management. Using ASTA system it is also possible to display how different tree disease is distributed in stand, if it is spread eventually or only locally in some spots in the stand, also it can be used for browsing and other tree damage monitoring in the stand.

In conclusion: in harsh environmental conditions on unprepared forest soil and soil prepared in furrows made by disc trench larger seedlings show better survival rate. Survival of seedlings are significantly impacted by micro topography, whereas mounded micro sites equalize local environmental conditions what reduce impact of micro topography.

**Keywords:** Forest regeneration, Latvia, ASTA system

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## Estimation of Productivity and Prime Cost of Logset 5HP GT Harvester in Thinning

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### Abstract

Productivity of a harvester is one of the most important factors affecting costs of mechanized harvesting, which in turn determines, if mechanized thinning will be profitable. Productivity is influenced by characteristics of the felling site, terrain, soil, meteorological conditions, technological and technical factors. The objective of this study is to evaluate productivity and costs of harvester Logset 5HP GT, equipped with the TH-45 head and increased boom length in thinning. Trials were conducted in Latvia, eastern Vidzeme, in coniferous stands. To evaluate productivity of Logset 5HP GT, a time study was carried out, taking into account volumes of harvested stems. Working time was accounted with the field PC Allegro CX, on which a time tracking software SDI was installed. Influence of smaller trees (diameter < 8 cm) on productivity and cutting costs was also determined. 2379 trees were harvested with the total stem volume of 400 m<sup>3</sup>. The average diameter of a harvested tree was 14 cm and volume of a stem – 0.171 m<sup>3</sup>. Duration of time study was 33.5 h. Obtained productivity rates of Logset 5HP GT were compared with those of harvester John Deere 1070 D. According to the study results average productivity of harvester Logset 5HP GT in thinning of coniferous stands is 13.85 m<sup>3</sup> per productive work hour. Cutting costs of harvester Logset 5HP GT are 8.02 € m<sup>-3</sup>. Increased boom length allows to decrease the total time consumed when driving in stand by 71%. Harvesting small trees reduced productivity by 6.9% and increased production costs by 2.1%. Difference between productivity of Logset 5HP and John Deere 1070 D under similar conditions was statistically insignificant. Additional empirical data from trials, carried out in forest stands with various densities, are required in order to estimate influence of increased boom length and other parameters on productivity of the harvester with higher accuracy.

**Keywords:** harvester, Logset 5HP GT, harvesting productivity, thinning

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## Productivity of Vimek 610.2 Forwarder in Thinning

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### Abstract

Effective timber forwarding is one of the main requirements for cost-efficient logging services. With increasing awareness of the possible impact of forest machines on soil, requirements of soil protection are becoming stricter. The aim of the study is to investigate productivity of Vimek 610.2 forwarder in thinning and soil compaction, caused by forwarding. Trials were conducted in Latvia, in 2 forest stands located in northern Courland, in the forest compartment in Engure. The Vimek 610.2 Biocombi harvester was used as a forwarder in trials. It was equipped with Mowi P25 crane, caterpillars and net chains that enhance passability on soils with lowered bearing capacity. Detailed time studies were implemented for 56 forwarder loads. Working time was evaluated according to operations of forwarder’s manipulator (13 operations in total). Productivity of Vimek 610.2 forwarder under optimal and extreme conditions is determined based on the time study results and the prime cost of roundwood forwarding service. Results show that productivity of forwarder Vimek 610.2, recalculated in productive time consumption for forwarding  $1\text{m}^3$  of timber, under optimal conditions is 6.03 min and under extreme conditions – 6.23 min. Influence of forwarding conditions is significant and it mainly consists of time consumed for road packing and other activities related to difficult forwarding conditions. In soils with lowered bearing capacity forwarder Vimek 610.2 did not cause additional soil compaction and in areas with optimal soil bearing capacity soil compaction was detected only on surface. However long-term observations in thinned stands are needed in order to conclude, if lowered pressure on soil has a positive impact on further stand development. Prime costs of timber forwarding with Vimek 610.2 under optimal conditions in 150 m distance is  $2.23 \text{ € m}^{-3}$ , but under extreme conditions in 184 m distance it is  $2.75 \text{ € m}^{-3}$ . In



practice prime costs will be influenced by machine load, operator salaries and other factors.

**Keywords:** forwarder, Vimek 610.2, soil compaction, productivity

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## Comparison of Productivity of Kranman Bison 10000 Forwarder in Stands Harvested With Harvester and Chainsaw

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### Abstract

The aim of this study is to investigation of potential uses of Kranman Bison 10000 6WD forwarder in stands, where roundwood is extracted with a chainsaw and Vimek 404 T5 harvester working in normal and difficult forwarding conditions. John Deere 810 forwarder was used to compare productivity of Kranman forwarder with that of a *medium*-sized forwarder under normal conditions. In total 230 loads were forwarded during the study, including 63 loads from areas, harvested with a chainsaw, and 167 loads from areas, harvested with Vimek 404 harvester. The average forwarded load is 2.0 m<sup>3</sup> (the maximum load is 2.5 m<sup>3</sup> therefore the average load capacity is 80%). In average 33 minutes of productive work time were spent by forwarding one load (the proportion of productive working time is 94% from total engine hours of the machine). The average length of forwarding road in trials is 286 m. Forwarding of 1 m<sup>3</sup> takes 16 minutes of productive working time, but in difficult forwarding conditions the ttime consumption increases by 15%. The average forwarder fuel consumption is 1.8 L per hour. Accordingly, 0.4 L of fuel is consumed to forward 1 m<sup>3</sup> roundwood. In comparison, John Deere 810 under similar conditions consumed 1.3 L fuel to forward 1 m<sup>3</sup> roundwood. Study results prove that the best application of Kranman Bison 10000 is forwarding small stands or

individual trees, when logging with a chainsaw. Forwarder can work on soils with weak bearing capacity, however productivity can be significantly hindered by stumps and uneven terrain.

The study is implemented within the scope of the memorandum between LSFRI Silava and Joint stock company “Latvia state forests” from 11.10.2011.

**Keywords:** Kranman Bison 10000, productivity, thinning

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## **Multifunctional Rural Development – a Comparative Analysis of Municipalities Adjacent to the City of Olsztyn**

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### **Abstract**

Rural areas have multiple functions. Four key functions can be identified in a synthetic approach: economic, environmental, social and cultural. Multidirectional rural development is strongly influenced by spatial attributes, demographics, environmental factors, infrastructure and capital. Multidirectional development is closely associated with the multiple functions of rural areas. In general, multifunctional rural development involves rural activation and rural business diversification which enables members of the rural community to derive incomes from non-farming activities. The growth potential of rural municipalities is an important determinant of multifunctional development. The aim of this study was to analyze the level of socioeconomic development in rural municipalities, which is an indicator of their multifunctional development.

The quality of the local environment was assessed based on landscape value, climate, soil and air quality, natural resources, water resources, community involvement in environmental protection and formal protection measures. The

analyzed social criteria were economic activity rate, educational attainment, age dependency ratio and employment rate. The economic criteria were local government expenditures per capita, local government revenues per capita, area of agricultural land and farm area. The infrastructure criteria were the development of social and technical infrastructure.

The analyzed municipalities are situated in the Region of Warmia and Mazury in north-east Poland. Olsztyn is the capital of the region, and the examined municipalities are adjacent to the city. These municipalities are bedroom communities whose residents commute to work in the urban center. The study analyzed 15 indicators describing the four key areas of multifunctional development: environmental, social, economic and infrastructural. Data for 2013-2015 were acquired from the Central Statistical Office and statistical tables of the agricultural productivity index. The results indicate that the municipality of Purda (with relatively poor soils) meets the highest number of criteria and the municipality of Dywity (with relatively high-quality soils) meets the lowest number of criteria for multifunctional development.

**Keywords:** multifunctional development, rural areas, indicators of environmental, social, economic and infrastructure potential

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## **Soil Genotoxicity Biomonitoring in Recultivated Factory Area Using the Cytogenetic and Molecular Assays in Two Plant Test- Systems**

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### **Abstract**

Soil pollution at the abandoned areas of industrial establishments is of real danger when recultivated carelessly. Special care must be taken into assuring cleaning of ecological risk areas due to the potential threat of toxicant leftovers as there are cases when demolishing wreckage with soil admixture is reused for rural road restoration.

Our aim was to monitor soil genotoxicity at the abandoned brownfield that is recultivated into a residential zone using *Allium* and *Tradescantia* #4430 test-systems. Soil samples were collected in 3 rounds: 1<sup>st</sup> – soil from the central part of the brownfield before the recultivation, 2<sup>nd</sup> – soil removed from the territory before the construction works, 3<sup>rd</sup> – soil from the site periphery with no construction going on. Chemical analysis of the soil revealed that whole territory is extremely polluted with high levels of heavy metals. Total contamination index was 874 in the 1<sup>st</sup>, 225 in 2<sup>nd</sup>, 135 in 3<sup>rd</sup> sampling soil, when the permissible value is <16.

Cytogenetic markers in *Allium* were recorded after 48 h growth in the soil and in *Tradescantia* after 6 h exposure to the H<sub>2</sub>O and DMSO soil extracts. Two types of molecular markers, RAPD and ISSR, were analysed in *Allium* after 96 h growth in the soil.

The 1<sup>st</sup> sampling soil has induced an alarming increase of apoptotic cells in *Allium*. Micronuclei frequency and inhibition of the mitotic activity in *Allium* decreased consistently along with the contamination reduction in the soil. Cluster analysis of *Allium* RAPD and ISSR markers showed that the 1<sup>st</sup> and 2<sup>nd</sup> sampling soil has induced similar genetic changes in onions but different from the 3<sup>rd</sup> sampling soil. Increased frequencies of all cytogenetic markers were also revealed in *Tradescantia* cuttings after exposure to the extracts of 1<sup>st</sup> sampling soil and this data correlated with *Allium* results.

Application of bioassay battery gives a more complex view into potentially harmful effects in organisms exposed to the polluted soil as the response might be inconsistent in organisms of different sensitivity. Both test-systems in this study confirm that soil from the former factory area is harmful to plants and is potentially hazardous to people (grant No.MIP-042/2015).

**Keywords:** *Allium*, cytogenetic markers, ISSR, RAPD, soil genotoxicity, *Tradescantia*

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## **Implementation of EU Water Policy in Ukraine: Problems and Perspectives**

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### **Abstract**

The use, protection and management of water resources belong to the most urgent among global environmental problems of our time. Today, the civilization clearly realizes the need for careful management of water resources, maintaining and restoring its quality. Water quality determines the possibility of its use in various fields of human activity. For Ukraine, problems of water sector are also acute and urgent. Low efficiency of water use, poor drinking water quality, nitrate contamination of water resources, poor condition of water bodies in Ukraine require more foreign experience in this sphere, especially the EU experience.

The purpose of our scholarly work is to explore actual problems of harmonization of water legislation of Ukraine with the requirements of EU water policy and development of proposals for the improvement of Ukrainian legislation. Main features of harmonization of Ukrainian legislation in the water resources management sphere with EU law and prospects for implementation of principles of EU Water Framework Directive were analyzed. As a result of the study the ways of implementation of positive foreign experience of water objects management in Ukraine are considered.

The methods of comparative, analytical, statistical and logical analysis were used. Taking part in the project 575523-EPP-1-2016-1-UAEPPJMO-MODULE "EU Environmental Policy and Law" we have studied European standards in the field of water resources quality, found some gaps in Ukrainian legislation and filled them in. As a result of the study draft law "On prevention and elimination of damage caused to the environment" was elaborated.

Ukraine's legislation partly complies with the Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. At the same time

in Ukraine the following measures should be taken in order to adapt Ukrainian legislation to the Water Framework Directive: inclusion in the Water Code of Ukraine provisions on river basin management plans which should comply with article 11 of the Directive; development of river basin management plans; development of the system of water-related issues monitoring; development and fixing in the legal framework assessment criteria of the river basin; adoption and implementation of provisions of the EU Water Framework Directive concerning public information and consultation.

**Keywords:** Water management, water legislation, water resources, water quality, EU water policy

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## **Assessment of Economic Losses Associated with Nitrogen and Phosphorus Leaching in Agricultural Land in Latvia**

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### **Abstract**

Water is significantly important resource in everyday life. Water is used by humans to provide physiological processes, both in the form of direct consumption as a drinking water and in the form of food, also used in industrial and agricultural processes, and in the domestic sector. Indicators that characterize water resources are affected by human activities. Those activities may lead to various types of pollution. Water pollution with plant nutrients in Latvia is often related to agricultural activities. As water circulation is sustained and uninterrupted process, nitrogen and phosphorus compounds are lost throughout the hydrographic network and transported locally and internationally. Increased levels of nitrogen and phosphorous compounds in the water lead to intensive eutrophication processes in inland water bodies and the Baltic Sea, therefore, the amount of clean water is decreasing. It is necessary to minimize and prevent water pollution as much as possible.

This research aims is to evaluate the economic losses caused by nitrogen and phosphorus leakage through agricultural drainage systems. For this purpose

water protection regulations and agricultural runoff monitoring data on nitrates and phosphates leaching measured in Latvia are examined.

Evaluation process of the economic losses includes characterization of research areas, comparison of the maximum extent permitted rates of nitrogen and phosphorus application, optimum application rates and application rates at the research sites and other activities that allow to evaluate ecological and economic losses caused by irrational fertilizers application in the research sites. This paper also provides the information about the most effective methods applied to prevent leaching of nitrogen and phosphorus that are suitable for conditions in Latvia. For example, to prevent surplus nutrient leakage in the water, crop fertilization plan should be developed or to prevent consequences of nutrient losses constructed wetlands that can purify water can be established in the agricultural landscape.

**Keywords:** agriculture, drainage, nitrogen, phosphorus, leaching, economic losses.

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## Significance of Thinning Degraded Swamps Forest Stands in Sustainable Ecosystem`s Development

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### Abstract

After construction of drainage ditches, thus changing its natural hydrologic regime, swamps have been degraded, leaving a negative impact also on the adjacent unaffected and slightly affected hydrologic regime of raised swamps and other wetlands. Since after drainage of swamps and its adjacent forest area swamps became overgrown with trees, density of tree stands increased in the swamp`s territory and its adjacent forest stands. The large volume of crown by

interception limits rainwater from reaching the ground, because it evaporates from crowns back into the atmosphere, as well as trees favour water absorption from the soil through the roots that further enhance the drainage effect.

In scope of sustainable ecosystem development tree thinning is important, because by eradicating the effect of drainage in raised swamps, negative impact on adjacent intact or relatively intact raised swamps and hydrological regime of other wetlands is lowered. Habitat conservation value in long-term is the same as for habitat 7110\* *Intact raised swamps*, as in case of hydrological regime restoration, within time it will transform into 7110\*. Several specially protected plant species can be found only in raised swamps.

Evapotranspiration volume varies depending on air temperature and solar radiation. Since in reality it is impossible to change air temperature or solar radiation in order to increase the groundwater level in a swamp, we can reduce the leaf area index (LAI) – by cutting down trees.

Aim of this paper is to examine how LAI interacts with groundwater level by using system dynamics swamp's ecosystem model. Swamp's ecosystem model shows correlation between LAI and groundwater level.

As a result of this research we can observe, that LAI interacts groundwater level and system dynamics modelling could be useful to calculate degraded swamp's forest stands thinning intensity through mathematical relationships.

**Keywords:** leaf area index, groundwater level, system dynamics, swamp

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## **Information Policy in the Environmental Sphere in the Context of Sustainable Development of Ukraine and the EU**

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### **Abstract**

The purpose of this research is to develop a legal mechanism for ensuring the right to access environmental information to ensure sustainable development of society. In the context of our study we developing an understanding of



information human rights - the right to collect, disseminate, use and preserve environmental information is fundamental and natural.

We understand information human rights as a group of rights with a center around freedom of information, the right to environmental information, the right to communication in environmental sphere, the right to access to environmental information that is public or socially significant, the right to privacy, the protection of personal data.

In the EU, access to environmental information is regulated by Directive 2003/4 / EC (Aarhus directive). Citizens of the EU have the right to receive this information within one month from the moment they ask and not to mention why they need it. In addition, public authorities are required to actively disseminate information on environmental information at their disposal.

In Ukraine defined system of a jurisdiction whose collection includes different types of environmental information and formation of information environmental policy. But the issue of public administration in the field of environmental protection is currently split between different executive bodies; there is no united information policy and the body responsible for it. There is no obligation for the authorities to inform the population even in crisis situations.

This study will form the legal framework to ensure the right of access to environmental information in Ukraine by introducing the position of Information Commissioner - is an official within the competence of which includes monitoring compliance information law and information policy in the environmental field.

**Keywords:** environmental information, information human rights, Information Commissioner, sustainable development

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## An Assessment of Retention Trees in *Hylocomiosa* Forest Type in Southern Latvia

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### Abstract

In Latvia the forest legislation requires that at least 5 retention trees must be saved per hectare after the clear-cutting. It is known that retention trees significantly increase the biodiversity in production forest landscape. After the clear-cutting retention trees are the habitats for various lichens, mosses, insects, fungi and birds. Over time retention trees became incorporated into the young forest stand and provide presence of old trees, that are necessary for many endangered and rare species. After the death, these trees turn into coarse woody debris which is essential habitat and feeding source for many taxa. However, the conservation and mortality of the retention trees has not been studied extensively because this approach has been established recently. The aim of this study was to evaluate development of the retention trees in *Hylocomiosa* type of forests in Southern Latvia. In total 11 young forest stands were surveyed in 2009 and 2015. The total area – 13.7 ha, on average forest stand size varies from 0.5 to 3.0 ha. All the studied sites were harvested in 2002, 2004, 2006 and 2008. All measurements of tree species, height, and diameter and defoliation class were assessed and the status of tree (growing tree, coarse woody debris – snags, stems and downed logs) was indicated. Results show that after the studied period of seven years 24 retention trees died. Average level of tree mortality is 15 %. The mortality level of Scots pine retention trees is 5.8 %, for aspen – 50 % and that for birch – 92.3 %. On average there are 8.5 green retention trees per 1 ha of young stand ( $22.9 \text{ m}^3 \text{ ha}^{-1}$ ). On average 2.3 pieces of coarse woody debris are per 1 ha of young stand ( $3.52 \text{ m}^3 \text{ ha}^{-1}$ ), mostly - aspen wood ( $2.4 \text{ m}^3 \text{ ha}^{-1}$ ). Woody debris of the young stands is divided into the first 4 decay levels according to Hunter classification (Stokland et al., 2001). 50 % of the listed woody debris is related to the 3<sup>rd</sup> decay level which means that woody debris is moderately decomposed.

**Keywords:** retention trees, clear-cutting, tree mortality, species diversity

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## **The Health Status and Natural Regeneration of *Pinus sylvestris* L. After the Surface Fire in *Vacciniosa* Forest Type in Latvia**

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### **Abstract**

From abiotic factors the most effecting influence on forest ecosystems has fire. Last year, 466.53 hectares (ha) of forest land was burned in Latvia, incl. 117.8 ha young forest stands. The average forest fire area in Latvia was 0.62 ha in the last 5 years (VMD, 2016). Two years after surface fire in the pine stands growing in *Vacciniosa* forest type (total area 4.8 ha) 4 sample plots (hereinafter PL) were established. Each PL size was 20x20 m. Two PLs were installed in medium-aged (49 years old, 2.3 ha) and two PLs - in maturing (96 years old, 2.5 ha) stands. In each PL, the numbering of the trees was carried out and their placement was fixed, as well as the diameter of all trees at a height of 1.3 m above the root collar and the height of trees and the height of the green crown were measured. The sanitary condition of each tree was evaluated. For registration of one-year and two-year seedlings in each sample plot 25 sampling units (1 m<sup>2</sup>) were used. The similar sampling units were used for evaluation of ground cover (5 in each sample plot, diagonally arranged), the obtained samples were weighed. The purpose of the study was to analyze the health status and natural regeneration of *Pinus sylvestris* L. after the surface fire in the *Vacciniosa* growing conditions. The ground vegetation was completely burned out in the medium-aged stand, but in the maturing stand both ground vegetation and organic layer - mosaically. The average burning height of the trees in the medium-aged forest stand was found to be 0.6±0.64 m, but the highest burning level - 3.1±0.18 m, in the maturing stand - at 2.3±3.4 m and 4.6±0.25 m, respectively. The natural regeneration of pine was not detected in the first year after surface fire in the medium-aged forest (only 73200 one-year seedlings

were recorded at the second year after fire), while in the maturing stand it was successful at this time (46600 one-year-seedlings and 14200 two-year-seedlings). Insect damage was not detected.

**Keywords:** vegetation, burning height, ground cover, medium age stand

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## **Growth Differences of Silver Birch *Betula pendula* Roth and Downy Birch *B. pubescens* Ehrh. Growing on Drained Soils in South Latvia**

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### **Abstract**

In Latvia birch occupied areas only increase. According to the State Forest Service information for the year 2016 birch occupied 30% of whole forest area (3.38 million ha). But how much of these areas are taking up silver birch and how much - downy birch? It is unknown. Although between these two species have dendrological differences, however in forest inventory it is not taken into account. There is also a variety of wood properties which are not respected in the timber market. The main aim of this research study is to analyze growth differences between both birch growing in the same conditions. For collecting of empirical data two sample plots created (the first plot area 0.18 m<sup>2</sup> (40 x 45 m), the second - 0.20 m<sup>2</sup> (40x40 m). The selected stands have been regenerated naturally and two times repeatedly drained. The forest stand investigated is 65 years old mixed stand dominated by birch (silver birch and downy birch) which makes up 90 % of total growing stock and pine (*Pinus sylvestris* L.) – 10 %. In each plot for all the trees have been measured diameter at 1.3 m above root collar (with an accuracy 1 mm), height (with an accuracy 0.1 m) and using

Pressler borer have been taken core samples. The widths of tree rings have been measured using Lin TAB system microscope and computer software T-Tools Pro.

Analyzing the dynamics of diameter and height growth in both sample plots it has been observed that silver birch shows higher values than downy birch ( $p < 0.05$ ). In the last 30 years both birch species show systematic reduction of the annual increment. Decrease of height growth for both birch species in *Vacciniosa mel.* - 0.66-0.26 m and the difference - 0.4 m. Decrease of *Betula pendula* Roth height growth in *Vacciniosa turf. mel.* - 0.70-0.39 m and the difference - 0.31 m while *B. pubescens* - 0.80-0.39 m and difference - 0.41 m. Decrease of the stem *diameter* at breast height (DBH) of *B. pendula* - 7.5-2.7 mm and difference - 4.8 mm while DBH of *B. pubescens* - 5.9-2.7 mm and difference - 3.2 mm. The increments of *B. pubescens* have increased only in years with more intense rainfall compared to the increments of *B. pendula*.

**Keywords:** silver birch, downy birch, growth

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## Succession of Ground Cover Vegetation in *hylocomiosa* Forest Site Type After the Clearcut

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### Abstract

Nowadays forestry sector uses forest site type descriptions developed from beginning of 20<sup>th</sup> century till 1980's and descriptions are obtained for pre-mature and mature stand age. There is less information about ground cover vegetation for full rotation cycle. In this research has been gathered information about ground cover vegetation succession in first 5 years after clear cut in

mature Scots pine stand. The chronosequence method was used. The Brown-Blanquet and the point-square methods for accounting of ground cover plants were used. The ecological values of Ellenberg for describing the environmental status and the coefficient of Tschekanovsky for estimation of the difference between plant communities in forest young growths of different age were used. The biological diversity of species in this research compared to mature stand also is increasing. Ellenberg's ecological indicator values as light and nitrogen are also increasing; nitrogen value has increased the most - by 2.62 units. There are registered changes in vascular plants, mosses, lichens and trees projective covering's proportion. The most significant changes in individual species occurrence are between the second and third year's (Tschekanovsky coefficient = 0.19). Five years after clear cut the Tschekanovsky coefficient between the mature stand and five years old clearing is 0.18. In the 4th and 5th year after the clear cut there increase the projective cover of *Monocyledonae* plants (families *Graminaea* and *Cyperaceae*) forming higher vertical structure and overtaking the dominance from another groups. The results obtained in this research promote further research in different stand age.

**Keywords:** forest site type, succession, ground cover vegetation, clear cut, rotation c

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## **Wild Blueberry (*Vaccinium myrtillus* L.) and Wild Cowberry (*Vaccinium vitis-idaea* L.) Obtaining Sites and Resources in Lozmetejkalns Surroundings in Latvia**

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### **Abstract**

The research analyses and evaluates changes in the dendrometric indicators of young forest stands over years, characterises the impact of various factors on the dendrometric indicators of young Scots pine (*Pinus sylvestris* L.) stands in three locations in Latvia - Akmensrags district of the Southern-Kurzeme Forestry of Joint Stock Company Latvian State Forests and in territories of the Kalsnava and Jelgava forest regions of the State Scientific Research Forest management agency "Forest Research Station". About 20 forest compartments of various sizes in Vacciniosa, Myrtillosa, Hylocomniosa, Vacciniosa mel., and Myrtillosa mel. forest site types were remeasured 2 or 3 times. Significant differences in dendrometric properties and growth course between today's stands and Growth Course Tables of year 1924 were obtained. It means that due to forest tree breeding, management and climate changes the trees are growing considerably faster as in past..

**Key words:** *Young growths, Scots pine, Growth Course Tables, height increment*

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## Nutrient Retention in Surface Flow Constructed Wetland in Agricultural Land in Latvia

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### Abstract

The research object is a pilot-scale surface flow constructed wetland at the farm Mezaciruli located in Zalenieki County, Jelgava Region, in the middle part of Latvia. The constructed wetland was installed in June 2014 to improve water quality from agricultural catchment and examine nutrient retention at the constructed wetland receiving surface and drainage runoff. The constructed wetland's surface area of 0.37 ha corresponds to 0.5 % of the total catchment area. The wetland is functionally divided into two parts with a maximum water depth of 2.10 m at the inflow part to facilitate sedimentation processes and a shallower part at the outflow with a maximum water depth of 1.40 m for nutrient transformation processes. The surface area of the inflow and outflow parts is 0.29 ha and 0.08 ha, respectively.

During the observation period of 32 months (2014-2017) water quality parameters such as total suspended solids (TSS), nitrate-nitrogen (NO<sub>3</sub>-N), ammonium-nitrogen (NH<sub>4</sub>-N), total nitrogen (TN), orthophosphate-phosphorus (PO<sub>4</sub>-P), and total phosphorus (TP) were monitored twice a month using a grab sample approach. Retention efficiency for monitored compounds was calculated based on their concentrations at the inlet and outlet. The monitoring results obtained during this study showed a reduction within the constructed wetland for all examined parameters. The concentrations of NO<sub>3</sub>-N, NH<sub>4</sub>-N and TN were reduced on average by 13 %, 15 % and 16 %, respectively. PO<sub>4</sub>-P and TP concentrations were reduced on average by 38 % and 36 %, respectively. Total suspended solids were reduced by 31% at the outlet of the constructed wetland. However, in some cases, there has been an increase in nutrient concentrations in water leaving the constructed wetland.

**Keywords:** Constructed wetland, nutrients, agricultural runoff

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## **The Social Actions of The State Forests in Poland**

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### **Abstract**

Poland takes the leading position in Europe as far as the forest area is concerned. The forests overgrow 9.1 million hectares which is 29.4% of the territory of Poland. The vast majority of this area are forests owned by the state, out of which almost 7.6 million hectares are under the State Forests Holding management. Educating society within the scope of forestry and environment is one of the main priorities of the State Forests. The State Forest's educational offer is aimed at children, youths and adults including people with disabilities. This is all about popularization of forestry and sustainable forest management knowledge. This article focuses on the social actions of the State Forest's operations based on an analysis of the data obtained from reports made by the State Forests. These information and materials were analyzed to identify the social aspects of actions realized by the State Forests in Poland. The Authors analyzed different kinds of activities of the State Forests connected with social aims. The results of the analyses were presented in table format. The results were used to analyze and to describe the social aspects of the State Forest's operations in forest area in Poland. The social actions of the State Forests in Poland have been very positive evaluated by Authors based on realized analyses.

**Keywords:** the State Forests, forests, social aspects of forests

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## The Natural Environment's Potential as a Driving Force Behind the Socio-Economic Development of Rural Areas

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### Abstract

All definitions of the natural environment's potential provided by the literature highlight the role of humans as entities making use of environmental resources. The natural environment creates conditions for life processes to occur by supplying raw materials and energy required to satisfy various human needs. It provides a basis and a precondition for socio-economic development. It is, however, difficult to define the natural environment's potential in its entirety, therefore the study focused on the resource-and-performance aspect of this potential.

Hence, the article aims at identifying the relationships between the level of the natural environment's potential and the level of socio-economic development of communes. The study involved communes located in Warmińsko-Mazurskie Voivodeship. The study was carried out in several stages and involved an analysis of the level of the natural environment's potential as well as of the meta-indicator that shows the socio-economic determinants of communes in a synthetic manner. The analysis of the relationships between the level of the natural environment's potential and the socio-economic development was performed using the Pearson product-moment correlation coefficient.

**Keywords:** rural areas, natural environment, socio-economic development, environmental potential

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## **Changes in Macronutrient Concentrations in Soil Solution Following Regeneration Felling in Pine and Spruce Stands: Whole-Tree Harvesting Versus Stem-Only Harvesting**

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### **Abstract**

While conventional forest management in boreal and hemiboreal conditions has traditionally been targeted to use and enhance provisioning services as timber production, the main goal of national and European forest policy is to ensure sustainable management of European forests in all aspects. Regeneration felling is a major disturbance in boreal and hemiboreal forests resulting in significant increase of organic matter on the forest floor in the form of logging residues (bark, small branches, tree tops) and severed roots (in case of stump harvesting), and can increase the risk of nutrient leaching. Recently, concern about the effect of forest management impact on macronutrient leaching potentially decreasing nutrient availability for the next forest generations and causing deterioration of water quality has been raised. In 2011, three objects to study the impact of different intensity regeneration felling (stem-only harvesting and whole-tree harvesting) were established in scientific research forests in Kalsnava forest district. Two sites were located on mineral soils (*Myrtillosa* and *Hylocomiosa* site type, dominant tree species *Pinus sylvestris* L.) and one on drained peat soil (*Oxalidosa turf. mel.* site type, dominant tree species *Picea abies* (L.) Karst.). Felling was performed in early spring 2013 with harvester, timber was extracted and logging residues were removed with forwarder, following “business as usual” principle. Soil solution samples were collected once or twice a month in 2012, 2013, 2014, 2015 and 2016. This study presents trends of pH, conductivity and macronutrient (NO<sub>3</sub>--N, PO<sub>43</sub>--P, K) concentrations during five years – one year before harvesting and four years following harvesting. In general, significant forest management impact expressed as increase of macronutrient concentrations in soil solution was detected in the second and third year after harvesting, but in the fourth year concentrations started to decrease again.

**Keywords:** Intensive forest management, Scots pine, Norway spruce, macronutrients, soil solution

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## **Bio-economy Based Business Models for the Forest Sector – A Systematic Literature Review**

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### **Abstract**

The shift towards a bio-economy is one of the main focus areas of political initiatives aiming for a society relying on renewable biological sources while achieving economic growth. The forest sector is expected to contribute significantly to the development of the bio-economy which at the same time support rural development by creating new markets for advanced forest based products. In literature much attention has been devoted to technical aspects of new bio-based products as well as political strategies to support a shift towards bio-economy. However there is a need to focus more on the economic feasibility of such initiatives and how new business models can be developed that enable the creation, delivery and capture of the potential value from forest based bio-economy. Literature on bio-economy often implicitly addresses certain aspects connected to business models but is lacking a holistic perspective on the role of business models for the successful shift towards a bio-economy in the forest sector. Therefore, the purpose of this paper is to conduct a systematic literature review about bio-economy business models in the forest sector to advance the understanding about increased and sufficient value generation necessary to persuade a shift towards bio-economy. This paper is based on a systematic review of 42 scientific journal articles and book chapters on forest based bio-economy. The first result of the article is a structured aggregation of the

existing bio-economy business models including the maturity and potential for large scale application. For example, the use of bio energy has come quite far compared to the application in pharmaceuticals. Second, policy implications for new business model development are analyzed in order to identify potential for improving the support strategies towards market diffusion. Finally, the main implication of the paper is an overall framework on how to facilitate the commercialization of bio-economy based business model through an improved understanding of how value is created, delivered and captured to reach market acceptance of innovative business models. Recommendations for future research are presented in the end of the paper.

**Keywords:** Bio-economy, Forest, Business models, Literature review

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## EU Framework for Forestry Support, it Implementation in Latvia

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### Abstract

Paper *EU framework for forestry support, it implementation in Latvia* covers analysis of most significant EU legal acts regulating financial support granted for private forestry in period 2014-2020, coherence to support measures implemented in Latvia for certain period. Evaluation of efficiency for implemented national forestry measures, found success, problem issues and disadvantages.

Method used for study includes review of documents, rules of responsible state authority's and data analysis of support amount obtained in private forestry sector.

Description of guiding principles, priority's for use of rural development fund and expected results in member states defined in **EU Forest Strategy for forests and the forest-based sector**.

Description of support measures for forestry laid own on **EU regulation on support for rural development by the European Agricultural Fund for Rural Development**. Purpose, implementation rules and restriction of forestry measures to foster private forestry.

Analysis of Latvian rural development programme 2014-2020, main attributes of implemented measures applicable for private forestry:

- knowledge transfer and information actions;
- advisory services;
- afforestation and creation of woodland;
- prevention and restoration of damage to forests from forest fires and natural disasters and catastrophic event;
- investments improving the resilience and environmental value of forest ecosystems;
- Setting -up of producer groups and organisations;
- NATURA 2000 forest payments;
- Innovations;
- national rural network.

Conclusions on gaps identified in nation measures, it internal regulation, compering to EU support framework:

- Investments in forestry technologies and in processing, in mobilising and in the marketing of forest products;
- Forest-environmental and climate services and forest conservation;

Conclusions and recommendation in ex-ante evaluation report, 2013, on draft version of nation rural development programme 2014-2020.

First data from national paying agency State Rural Support service indicating efficiency for particular support measures for period 2014-2017. Conclusion on problem issues, recommendations for needed incentive activitys.

**Keywords:** EU framework for forestry support, EU funds, private forestry, efficiency of nation legislation versus EU legal acts.

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## **Assessment of Historical Bio-index Changes in Rural Areas in Southern Poland – Case Study**

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### **Abstract**

Intensity of land use could be considered as an indicator of rate of anthropogenic impact on landscape (CAI) or coefficient of ecological stability (CES). These two indexes (bio-indexes) base on the land use categories (kind of coverage). The CAI coefficient is the ratio of the sum of percentile areas of land characterized by considerable human impact in relation to the sum of percentile areas of lands with low or none anthropogenic pressure. The CES index describes the structure of land use in one unit according to land use categories weighted by given coefficients. The calculation of the complex integral index enables to know the potential of the environment, i.e. a natural resource reserve existing in a given area with a structure that allows self-regulation of ecosystems and expresses the environment's resistance to bearing anthropogenic loads. The paper presents the results of a case study of historical bio-index changes of rural villages in Southern Poland for the period 1848-2016. The analysis led to the conclusion about the strong dynamics of changes during this period, which is largely due to the growth of the percentile areas of lands with considerable human impact especially after the historical transformation from 1989 in Poland. At the same time the attention should be given to the land use changes as an effect of growing suburbanization, especially in the periphery of big cities. The results of the study can be used by public authorities, citizens and governing bodies to form a system of measures to calculate environmental potential and modelling changes which ensure the environmental protection and sustainable development of rural areas.

**Keywords:** anthropogenic pressure, dynamics of land use changes, environmental potential, environment's resistance, rural areas, sustainable development

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## Assessment of the Agricultural Land Use of Šakiai District Municipality in Land Consolidation Project Area

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### Abstract

The object of research – the plots of land in Voniškių, Šileravos, Stulgių, Obeliškių villages of Šakiai district. These parts of the land were chosen as in Šakiai municipality very productive lands, cultivation entities, and strong agricultural companies prevail in Šakiai district. The aim – to analyze the land use of the land consolidation project implemented in the area of Šakių District Voniškių, Šileravos, Stulgių, Obeliškių villages.

Analyze the solutions of land consolidation project, the reformed land during the process. Detailed analysis of the company's use of land in Voniškiai is performed. The management form of land plot usage, how much and what kinds of crop are grown, which crops are grown in the consolidated land plots. It was also intended to find out what number of people possess the farms and what size of farms are these, and what activities are carried out in the consolidated lands without Voniškiai ŽŪB. The findings of the investigation show: 1. After implementation of the land consolidation project carried out in Šakiai district,



the average land area increased from 3.98 hectares to 5.69 hectares, the land configuration improved as well as their accessibility. 2. 151.5521 hectares belong to Voniškių ŽŪB. In consolidated plots winter rape and wheat, corn, beans, herbal plant mixtures are grown. In 2016 Voniškių ŽŪB crop area accounted for 1,480.94 hectares. 612.99 hectares of crops were grown in the consolidated lands, accounting for 40.07 percent.

**Keywords:** land consolidation, Šakiai district, project, land plots

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## Modeling of the Optimal Distribution of Motorway Overpasses on the Example of the A4 Motorway Section

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### Abstract

The developed, innovative method of estimating the impact of motorway on agricultural land allows determination of all the losses associated with the directions of this impact. The basis for the determination of losses is the analysis of variability in land use and the quality classes and location of access roads to the land along the axis of the planned motorway. The approved measure of the multidirectional impact of the motorway on agricultural land is a change in the value of land, which is designated taking into account the differentiation of their suitability for agricultural production.

The developed method of determining the impact of motorway on agricultural land was presented on the example of A4 motorway section between Bratkowice and Mrowla. The existing section of motorway was assessed and then for the same section the calculations were made again,

but with an alternative location of the motorway overpasses (flyovers). In the case of the existing section, the construction of one kilometer of the section of motorway under consideration will result in a reduction in the value of agricultural land of 1724 cereal units. Acquisition of land for the construction of the motorway and its negative impact cover about 69% of the total reduction in value of agricultural land. The remaining 31% of the land value reduction is related to the increase in transport and the deterioration of the plots layout. On the other hand, in the case of the section with alternative arrangement of viaducts, the value of agricultural land is reduced of 1575 cereal units. Acquisition of land under construction and its toxic impact will be equal 75%, while the combined effect of transport growth and deterioration of the layout makes 25%.

**Keywords:** value of agricultural land, motorway impact, farm

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## The Scale of Ecological Activities for the Maintenance of Sustainable Environment in Urban Amateur Gardens

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### Abstract

Though urban areas globally cover only about 3% of the earth's land surface, the UAGs have received a little attention with regards to their ecological facilities. The main aim of this study remains to assess and compare the choice

of ecological management options, which guidelines to improvement of environmental-friendly forms of gardening provided by two different UAGs, e.g. Užuoventja (U) and Nemunas (N) in Kaunas distr., central Lithuania.

The gardeners were interviewed to identify their preference of different gardening means and reasons for their ecological choices using a questionnaire ( $n = 60$ ) containing questions about gardening behaviour were surveyed.

The interviewed gardeners differ in their commitment and motivation, their agro-ecological practices, and their habits when growing fruits and vegetables. Ecological means, e.g. self-generated compost, turf and organic fertilizer were applied in 43.3-16.7; 16.7-6.7 and 43.3-16.7% in UAGs N and U, respectively. Only 3 or 10% (N) and 4 or 13.3% (U), of respondent regularly used chemical control means regularly. Unfortunately, only 11 or 36.7% (N) and 4 or 13.3% (U) of respondents regularly and sometimes used biological control means. While 7 or 23.3% (N) and 1 or 3.3% (U) of respondents apply biological control means on rare occasion. The large amount of gardeners', i.e. 63% (N) and 80% (U) employs the natural water resources.

This study shows that choice of the urban gardeners for the farming options proceeds the act of production through the conscious manipulation of natural resources, by the means of mobilizing practices (soil improvement, pest control means, watering), as well as supported by knowledge and sustainable viewpoint. Nonetheless, local ecosystem services will support gardener motivation, enhancing knowledge of sustainable gardening, authorizing the rational use of bio-control and soil improvement products, expresses an essential need for rational usage of water and other environmental resources.

**Keywords:** urban allotment gardens, ecology, sustainable options

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## Modified Wetlands with High Yields to Improve Water Management in Rural Areas

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### Abstract

One of the major environmental management problems facing Chile is the treatment of domestic wastewater in rural areas. Chile has an urban wastewater treatment cover of almost 100% and at the rural level it does not reach 5%. For the 5% coverage reached, conventional technologies such as active sludge and biodisc have been applied with poor results, since for this reality it is not a sustainable solution.

In this study, the efficiency of removal of organic matter from a subsurface flow wetland to which a wastewater treatment effluent collection device is incorporated is considered.

The results obtained were as expected, since when using the innovative device of effluent output, COD removal efficiency exceeds traditional solutions by 10%, achieving 90% removal efficiency.

It should be noted that by obtaining higher yields, it is possible to reduce wetland extensions for the same treatment horizon or to purify larger volumes of contaminated water, which results in a general reduction of costs and an optimization of the treatment system.

This opens up low-cost wastewater management windows with a considerable increase in efficiency and, as a result, chain linkages are established with the rural agricultural and livestock economies, since the waste water is treated and reused

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## The Value of Agricultural Greenhouse Gas Emission in EU Countries

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### Abstract

Reducing greenhouse gas emission is one of the most important challenges facing the global economy. The European Union is trying to fulfill its obligations in this area by obliging member countries to gradually reduce emissions. Monitoring and management of administrative solutions in this area is extremely important for achieving positive results. The monetary valuation of emissions can be one of the elements of such monitoring as well as increasing public awareness in terms of costs associated with it.

The aim of the article was to compare agricultural greenhouse gas emission in the European Union countries. Agriculture was selected as one of the sectors that significantly contributes to this emission, especially in case of nitrous oxide and methane, and has the potential to reduce it.

The study covered the years 2007-2015. Emissions' valuation was based on the Eurostat data and the average annual price of carbon dioxide allowances under the EU-ETS system. Leipzig (Germany) stock market data were used to determine the price.

The comparison of greenhouse gas emissions in the European Union countries and its changes over time shows that its value decreases significantly in the analysed period of time. This is mainly due to a decrease in the allowances prices, but the downward trend in the quantity of emission in most countries is also noticeable. The share of agriculture in greenhouse gas emission in the EU was 10% in 2015. Therefore, agriculture was not among sectors with the highest share, but its share is still significant. It is worth pointing out that the agricultural greenhouse gas emission is decreasing both in its quantity and value in the case of most European Union countries, which is a desirable phenomenon given the European Union policy in this regard. However, on the other hand, the share of agriculture in total emissions increased by 1.5% over the period considered.

**Keywords:** greenhouse gases, emission's valuation, agriculture, EU

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## Identification of Wet Areas in Forestry by Using LiDAR Based DEM

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### Abstract

Water tends to flow and accumulate in response to topographical characteristics of local area and gravitational potential energy. Remote sensing data like LiDAR (*Light detecting and ranging*) or satellite data can be used to identify local depressions where wet areas may occur. The aim of this study was to evaluate methods that can be used to identify wet areas and to prepare proposals for forest management that could be usable in Latvia. Study area includes fertile forest land on wet mineral soils and drained mineral soils with planted spruce (*Picea abies*) and available LiDAR data. Aim of this study was to determine correlation between topography of the area and forest regeneration. Map examples has been made to demonstrate methodology which allows to identify depressions with potentially hindered run-off. *Fill sinks* algorithm has shown best results in identifying wet areas and correlation with wet areas that were detected in field studies is 62%. TWI index is not suitable for this study because of relatively flat area. Result of this study reveals that wet areas have significant effect on tree species. In depressions, despite the fact that there has been planted spruce, main species are birch (*Betula pendula*) and black alder (*Alnus glutinosa*). Wet areas has not significant effect on tree height.

**Keywords:** Depressions, fill sink, wet areas.

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## **Forest Management and Water Quality in Latvia: Identifying Challenges and Seeking Solutions**

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### **Abstract**

Rise in human population, industrialization, urbanization, intensified agriculture and forestry pose considerable risks to water supply and quality both on global and regional scale. While freshwater resources are abundant in Latvia, during recent years increased attention has been devoted to water quality in relation to anthropogenic impacts. Forest cover in Latvia equals 52% and forest management and forest infrastructure building and maintenance are among the activities that may, directly or indirectly, affect water quality in headwater catchments. Sedimentation, eutrophication and export of hazardous substances, especially Hg, are of highest concern.

To address these topics, several initiatives have started recently. In 2011, cooperation programme between Latvian State Forest Research Institute “Silava” and JSC “Latvia’s State Forests” was started to evaluate the impact of forest management on the environment. This programme included research on the efficiency of water protection structures used at drainage system maintenance (sedimentation ponds, overland flow) and regeneration felling (bufferzones). In 2016, within the second stage of this cooperation programme, a study on the impact of forest road construction on water quality was started. Since 2016 LSFRI Silava is partner in the Interreg Baltic Sea Region Programme project “Water management in Baltic forests”. By focusing on drainage systems, riparian zones and beaver activity, this project aims at reducing nutrient and mercury export from forestry sites to streams and lakes. While this project mostly has a demonstration character, it will also offer novel results on mercury and methylmercury concentrations in beaver ponds in all participating states.

This paper aims at summarizing most important challenges related to the impact of forest management on water quality and corresponding recent initiatives striving to offer solutions

**Keywords:** Forest management and infrastructure building, water quality, water protection measures

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## **Influence of Biological Plant Care Products on the Growth and Qualitative Characteristics of Sweet Basil**

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### **Abstract**

Investigation has been carried out in 2014-2015 at Vytautas Magnus University Botanical garden. It has been determined that, the sweet basil in both 2014 (80.1 cm) and 2015 (80.8 cm) grew most when biological plant care products Canelys, Ekoflavon and Ekoflavon + Oleorgan were applied. In 2014, the most significant absolute dry matter content (92.20%) was accumulated using the Oleorgan product, and in 2015, significantly the highest dry matter content (90.19%) has been accumulated using Ecoflavon + Canelys. The most significant (11.64%) crude fibre content in 2014 has been obtained under Canelys product application, while in 2015, significantly the highest result (14.26%) has been collected by the control variant. Significantly the highest quantity of crude ash (19.44%) in 2014 has been determined when the plants were treated with Canelys bio-product, however in 2015, the best result (21.86%) has been obtained after the use of the Oleorgan bio-based product. The most significant (20.07%) crude protein content in 2014 has been accumulated when the plants were treated with Ekoflavon. Therefore, in 2015 significantly the highest (16.68%) crude protein content was found in the Ekoflavon + Canelys variant, still the result did not differ significantly from the variant where only Ecoflavon product was used.



The aim of the study was to investigate the influence of some biological products application on the growth and qualitative characteristics of sweet basil.

**Keywords:** sweet basil, biological plant care products.

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## Detection of Change in Drought Frequency in Bydgoszcz Region, Central Poland

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### Abstract

The aim of the work, carried out within the framework of research on currently occurring rather than predicted climate changes, was to confirm or deny the hypothesis of increasing incidence of droughts in the Bydgoszcz region (central Poland) over the years 1986-2015.

According to projections of climate change, the variability and extremity of weather conditions are expected to increase. In studies conducted under climate scenarios e.g. GISS Model E, HadCM3 and GFDL R15, it was shown that atmospheric precipitation variability in central Poland will increase even to 20

percent, depending on the scenario. This means a higher risk of drought occurrence in the future and the necessity to cover the increased water demands of vegetation during growing seasons. Some researches indicate that these changes are already taking place.

The material was the data of precipitation measurements gained from traditional weather station, located in a poorly urbanized and industrialized area, void of the impact of urban factor. According to WMO recommendations on homogeneity of time series, only sums of precipitation in the 30-year period were analysed (1986-2015). Dry periods in individual months, seasons, half-years and years were identified on the basis of the relative precipitation index, which is defined as the relation of precipitation sums in a given period to the long-term average.

The investigation confirmed that the average long-term sums of precipitation in analysed periods were generally consistent with the results presented in the current studies. This allows classifying Bydgoszcz to the areas with the lowest atmospheric precipitation in Poland. The precipitation sums in the years 1986-2015 were characterized by a very high temporal variability and thus increased the climatic risk of plants cultivation. The significant positive trend of precipitation sums in the years 1986-2015 was found only for the cold half-year, which is consistent with the projections of the IPCC report. In the Bydgoszcz region the frequency of the occurrence of extremely dry, very dry and dry months was 38.6%, of seasons 38.3%, half-years 35.0% and years 30.0%. There was no increased frequency of droughts in the analysed period, quite the opposite – there was a downward trend.

**Keywords:** climate change, atmospheric precipitation, drought

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## Biomass Models for Short Rotation Willow Plantations in Lithuania

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### Abstract

Despite of increasing areas of short rotation willow plantations in Lithuania, only very few studies have been done so far regarding the biomass production in these plantations. To fill this gap, the aim of this study was to develop biomass equations for fresh-weighted and for oven-dried willow biomass and to estimate the yield of short rotation plantations as expressed in fresh-weighted and oven-dried biomass.

The data required by this study was gathered in the western part of Lithuania, in the Šilutė and Tauragė regions. For this purpose, sample plots were established in 21 short rotation willow plantations managed by “Klasmann-Deilmann Bioenergy“. All of them were first rotation plantations grown for 3 to 4 years.

It was found that mean annual oven-dried biomass increment varied in these plantations from 0.2 to 7.6 tons per hectare per year. Additionally, the relations between stand level values were evaluated and a stand biomass yield model based on the mean stand height was developed. Relations on the plant level were analysed as well. As a result we developed biomass models based on the individual plant diameter for plant height as well as for fresh-weighted and for oven-dried biomass.

**Keywords:** Short rotation willow plantations, fresh-weighted and oven-dried biomass, mean annual increment, biomass models.

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## Early Development of Wolf Tree Progenies in Scots Pine (*Pinus sylvestris* L.)

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### Abstract

Wolf trees are the individuals, which grow faster than the surrounding trees, have a larger crown and other tree parameters, and utilize a larger growing space, thus reducing stand timber volume (Beck 2004, Makrickiene et al 2016). Such trees are usually undesired in the stands and are removed during the first thinnings, what makes their early recognition important for the forest management planing. Our study was aimed to to analyze the differences between the wolf trees' and regular trees' seed progenies from the beginning of their development.

The seeds for the progenies research were collected from 8 mature wolf trees in naturally-born gene conservation stand in Kurtuvenai. The seeds for the control were taken from the officially selected seed trees from the same stand. The seeds were sown into the plastic containers, wolf trees and regular trees separately. The parameters of the seedlings were assessed in the beginning and in the end of every growth period.

The results of our research revealed statistically significant differences in progeny size, form, phenology and stability. Progeny of wolf trees tended to inherit the wolf trees' form. Moreover, the difference between the progeny of the wolf trees and regular trees could be clearly visible already from the second growth period, what makes the early recognition of the wolf trees possible.

**Keywords:** morphotypes, tree differentiation, tree form, seedlings

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## **Potential Flood Impact on Natural and Socioeconomic Environment in Riga**

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### **Abstract**

Flood risk management is the process of data and information gathering, risk analysis and evaluation, appraisal of options, and making, implementing and reviewing decisions to reduce, control, accept or redistribute the flood risks. It is a continuous process of analysis, adjustment and adaptation of policies and actions taken to reduce the flood risk. Preventive measures and timely, reasonable flood risk prevention measures can help reduce the risk of floods and caused damages. In addition, protection against floods is primarily necessary for populated areas, especially when it comes to densely populated areas, since floods may affect a large number of citizens and their property thereby causing enormous material damage not only to the inhabitants of these territories but also to business infrastructure, respectively, it can result in significant material and socioeconomic losses. The aim of the paper is to evaluate the flood risk management theoretical and practical aspects, identify the potential impact of floods on natural and socioeconomic environment, as well as to show the usefulness of flood risk reduction measures. To reach this aim, the following tasks must be fulfilled: to research and characterize the definitions of flooding and flood risk in Latvia and the European Union; to study and characterize the flood risk management legal and institutional aspects; to carry out an analytical overview of the flood risk assessment on right bank of the Daugava River in Riga; to carry out a cost-benefit analysis of flood risk prevention measures on the right bank of the Daugava in Riga.

**Keywords:** flood risk, flood risk management, flood defence, risk governance

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## Mapping Land Covers as Potential Green Infrastructure for Human Well-being in Rural Settings

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### Abstract

Green infrastructure (GI) policy encourages spatial planning of natural and semi-natural areas that deliver biodiversity conservation and a wide range of ecosystem services (ES) important to human well-being. Much of the current literature relies on expert-led, top-down processes to investigate connections between landscapes and ES. Little is known regarding the preferences of residents, and how they connect land covers with delivery of ES important for their well-being. We identify and locate different land cover types as GI hubs and hotspots that provide multiple ES important for human well-being in rural settings. First, we surveyed 400 urban and rural residents to identify ES important for personal well-being and the land covers that deliver multiple ES in three counties that best represent the existing rural-urban gradient in Sweden. Second, to support planners' inclusion of GI we identified and located spatial concentrations of individual land covers providing multiple ES (GI hubs) and significant clusters of such land covers (GI hotspots). The majority of urban and rural respondents associated their well-being with lakes, mountains above the tree-line, old-growth forests, wooded-pastures, mature pine forests and rural farmsteads. The area proportion of each type of land cover hub is low and on average 3.5%. At least three land management strategies are needed to sustain GI hubs: 1) to maintain the composition, structure and function of natural

ecosystems; 2) to support traditional agroforestry and villages as social-ecological systems; and 3) to diversify the current intensive forest management approach.

**Keywords:** ecosystem services, land management, spatial planning, hotspots

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## Analysis of Polluted Places: Case of Land Degradation in Latvia

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### Abstract

The aim of the article is to analyse and evaluate the information on polluted and potentially polluted places registered in the Register of polluted and potentially polluted places in Latvia. Under the influence of various natural conditions and economic activities land and soil degradation processes are observed, resulting in degraded territories. Degraded territory is a territory which in result of economic or other activity or inaction has so far destroyed, damaged or abandoned that is impossible to use it properly without special restoration measures. One of the factors that can be used to assess land degradation and determine the type of land degradation is pollution. In accordance with the Law “On pollution” in Latvia have been established procedures for identification of polluted places and developed criteria which are used for assessment of risk level. On this basis the Centre for Environment, Geology and Meteorology of

Latvia has established and maintains the Register of polluted and potentially polluted places. In 2012 in Latvia 243 polluted and 2654 potentially polluted places were listed and registered. The largest concentration of polluted places is located in Riga, which is largest industrial centre in Latvia. The polluted place is soil, subsoil, water, sludge, as well as buildings, factories or other objects containing pollutants. Potentially polluted places can be listed according to unverified information.

**Keywords:** degraded territory, pollution, polluted place, potentially polluted place, restoration

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## The Share of Agriculture in Greenhouse Gas Emissions in European Union Countries – Valuation

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### Abstract

Reducing greenhouse gas emissions is one of the major environmental challenges of the modern world. The European Union has set itself ambitious reduction targets. Their implementation requires not only the constancy, but also the skillful selection of goals depending on the specific nature of the economic sectors. Proper monitoring of emissions and its valuation is necessary to achieve this goal. In addition valuation (in monetary terms) will help to raise awareness of the climate change costs among society and thereby increase the chances of reducing emissions, especially from diffuse sources.



The aim of this article is to present international comparisons within the European Union covering the monitoring and valuation of aggregate emissions of selected greenhouse gases. Attention was paid to the analysis of the sectoral emission in individual countries, with particular emphasis on agriculture. The study uses Eurostat data for the years 2007-2015. The evaluation was based on the average annual price of carbon dioxide allowances under the European Union Emissions Trading System. Leipzig stock market data were used to determine the price.

The study compares the total greenhouse gas emissions and its value in different EU countries. These results show that the largest emitters in the EU are Germany, United Kingdom, France, Italy and Poland. A comparison of per capita emissions results in a reversal of this order. Similarly, in the assessment of emissions in the context of GDP the results are different. The share of agriculture in greenhouse gas emissions is also indicated. The results show that the decline in value is greater than the decrease in emissions. This is due to the dramatic change in the price of emissions in 2012 and 2013, which is mainly related to the implementation of the third phase of operation of the EU ETS. Wherefore presented valuation method is suitable for comparing different entities at a given moment, while the assessment of volatility over time should be very careful.

**Keywords:** greenhouse gases, emission, emission's valuation, EU, country comparison

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## European Beavers (*Castor fiber* L.) dams rebuild intensity

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### Abstract

European Beaver (*Castor fiber* L.) was reintroduced in Lithuania on 1947. Population growth was quite rapid and there were about 6000 beavers on 1970. Nowadays beavers population in Lithuania is about 40 000. Beavers have a possibility to affect the environment where they live by building dams, lodges, making caves systems, changing water level. Because of being such an active environmental former beaver has a huge indirect impact for forest and agricultural fields – higher water level usually causes damage for forest trees or crops. There are different studies about this beaver's ability to change environment and to build dams, lodges. Explanations why it is needed for this species now is clear, but still there are question how can these animal plan, organise and improve their ability to build. The aim of this research is to find out if dams rebuilt activity intensity differs during different year seasons and is it affected by the beaver's family size in current place. According to our findings, the beginning of dam rebuilt and total dam rebuilt depends on year season – on fall season it takes 4 times less time. In addition to this, family size has an effect – bigger families rebuilt dams faster. Usually beavers do this job from midnight to 2 a.m. on fall season.

**Keywords:** European beaver, dam, rebuild

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## Comparison of Photosynthetic Parameters in Different Wheat (*Triticum aestivum* L.) Varieties

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### Abstract

Dynamics of photosynthesis pigments in the leaves of different varieties of winter wheat during the vegetation period is analyzed in the paper. The accumulation of pigments in the plant depends on the physiological activity, growth and development of the plant, therefore the composition and content of photosynthesis pigments chlorophyll a, b and carotenoids reflect the general condition of the plant. The ratio of chlorophyll a / b for normal photosynthesis activity in the leaves of the plant should be at least 1:3. The object of the research is different varieties of winter wheat (*Triticum aestivum* L.) - 'Artist', 'Edvin', 'Skagen', 'Bertold' and 'Viola'. Field experiment was carried out at the Experimental Station of Aleksandras Stulginskis University in 2015-2016. Soil type was identified as *IDg8 - k (LVg - p - w - cc)* - shallow calcareous luvisol (*Calc (ar) i - Epihypogleyic Luvisols*). Agrochemical parameters of the soil were determined using accepted analytical methods. The content of photosynthesis pigments (chlorophyll a, b and carotenoids) in green leaf mass was determined in 96% ethyl alcohol extract applying spectrophotometric Wettstein method, "Genesys" 6 spectrophotometer. The photosynthesis productivity ( $F_{pr}$ ) was calculated according to the formula:  $F_{pr} = 2 (M_2 - M_1) / (L_1 + L_2) T$ . The accuracy of the data analysis was estimated according to the standard measurement deviation from the mean. The highest content of photosynthesis pigments has been accumulated by winter wheat variety 'Skagen'. The best result has been observed at the end of nodding stage. A lower content of photosynthesis pigments has been found in the leaves of 'Edvin', 'Viola' and 'Artist' varieties. The highest photosynthesis productivity of all winter wheat varieties has been recorded at the end of nodding stage, and decrease of photosynthesis productivity has been observed since milk maturity stage.

**Keywords:** Winter wheat, photosynthesis pigments, varieties.

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## Criteria of Economic Efficiency of Land Stock Management

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### Abstract

One of preconditions for sustainable socio-economic development of the region can be observed as much as possible involvement of land resources in economic turnover and increasing of efficiency of their use.

On the example of Samara region which is the subject of the Russian Federation are made proposals for establishment of criteria for assessment of economic efficiency of land management in specific area. Statistical data on collection of land payments (land tax and leasehold payment) in 27 municipalities of Samara region in 2012-2014 are analysed. There is investigated common information on Samara region - location, total land stock area, agricultural land area, distance between main city of region and territory, number of inhabitants, density of population, etc. Methods of mathematical statistics, regression and factor cluster analysis are used. The indicators most influencing the volume of land payments are determined and is developed the model of coherence between level of payments and geographical and demographic characteristics of the municipality. The model allows to estimate the “normative level” for each region according to objective characteristics and to rank the regions according

to this indicator. The given criteria allow to estimate efficiency of land resources management taking into consideration different potentialities of municipalities of the Samara region.

Land payments are local taxes, therefore they are an important source of the formation of financial basis of local governments in Russian Federation and play an important role in the socio-economic development of the regions.

**Keywords:** criteria of economic efficiency, governance, land stock, land payment, land tax, leasehold payment, leasehold

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## The EU Funds and the Afforestation of Private Agricultural Land

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### Abstract

The size of afforestation area shows the larger role of privately owned land than land owned by the State Treasury, including land managed by the state-owned corporation “Lasy Państwowe”, in Poland in the period 1991-2010. In the case of afforestation area growth in individual voivodships, the largest gains have been observed in Mazowieckie Voivodship (where private forests are the most numerous), Lubelskie, Świętokrzyskie, Warmińsko-Mazurskie and Podlaskie between 1991 and 2010. Changes in the afforested land area, and thus the increase in the level of forest cover in Poland, are largely the result of EU subsidies under RDP 2004-2006 and RDP 2007-2013. In the period 2014-2020, afforestation in Poland is supported by RDP 2014-2020 whose conditions differ from the earlier period. This study examines the role of EU funds in increasing

the area of private forests using the example of Podlaskie Voivodship and compares the growth rate of afforestation to the changes taking place throughout the country in the period 2014-2016. The growth of afforested land is crucial for the implementation of the National Forest Improvement Program, which envisages that forest cover will reach 30% by 2020. The EU afforestation support program results in reallocation of land away from agricultural production. The future role of private forests will grow in importance as the land area that can be afforested decreases. The incentive for the farmer are the expected economic benefits derived from subsidies financed by the EU funds. A farmer faces a choice between competing benefits of afforestation subsidies and field crop subsidies under the Common Agricultural Policy.

**Keywords:** EU funds, afforestation, private agricultural land, Podlaskie Voivodship

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## **Do We Need protective Plantations Along Railways (Lithuanian Case Study)?**

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### **Abstract**

Differently to other European countries Lithuania has inherited from Soviet time period quite width protection zones of state importance with wooden plantations along railways. Those protection zones vary from 20 m (in cities) up to 45 -70 m (in rural areas). In total planted of spontaneous wooden plantation occupy over 2 thous. ha. The status of protective plantations serve for multifunctional purposes by ensuring railway traffic safety, mitigating

negative impact of railway traffic, exhibiting Lithuanian landscape image for travellers, improving landscape connectivity, living and working environment welfare. At the same there is a challenge for proper management and profitability. Most of during Soviet time planted pioneer species reach or is going to reach mature age. There is increasing the threat of dangerous trees, ensuring continuous cover of protective plantations, continuous services and structure satisfaction of predominating function.

This study presents the challenges for future development and society preferences to services of protective plantations along railways. The results of analysis of present condition of railway lineside vegetation, as well the results of social survey showed, what it is not enough just to manage the dangerous trees for railway safeness but it is essential complex means for protective plantations development, services succession.

The study was carried out on the frame of research work ordered by JSC "Centre of railway environment protection" in 2015-2016."

**Keywords:** railways, protective plantations, lineside vegetation, social preferences

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## Diversity of Herbaceous Vegetation After Forest Fire

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### Abstract

Forest fire is an uncontrolled combustion of flammable materials in forested and non-forested areas. In Lithuania forest fires mainly occur in late spring and summer, mostly in young coniferous forests (Forest ..., 1987).

The studies of herbaceous plants in fireplaces were carried out in 2016 in Jurbarkas SFE. Ground-level forest fire increased the projection coverage of herbaceous plants and their species composition in the fireplaces. According to the average data of the survey, 18 herbaceous plant species were ascertained in the fireplace and 14 species in the control stand. During the first year after fire, 9 new species were recorded in the fireplace and 5 species have disappeared, while in the seventh year - 7 new species were recorded and 1 disappeared, as compared with the control stand. Summarizing the obtained data it can be stated that low-intensity ground-level forest fire in pine forest increased the number of herbaceous plant species, however, the number of new and extinct species has been gradually decreasing, suggesting that in the fireplaces the diversity of herbaceous plant species will be like in the control stand.

**Keywords:** Forest fire, herbaceous plants, projection coverage

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## Water Quality and Waste Contamination Study in Catfish Rearing Recirculating Aquaculture System

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### Abstract

In this article we analyse catfish rearing conditions in recirculating aquaculture systems (RAS). Based on research, performed by scientists from different countries, we evaluated optimal water parameter values for catfish rearing. African catfish growing process and with it associated factors were researched in JC „Šamas“. The amount of dissolved oxygen (on average 4,53 mg/l) in the rearing basin is adequate for the catfish to feel comfortable and for biomass growth. Water temperature only varies slightly – the average water temperature is 23,3<sup>0</sup>C. The ideal pH for rearing fish in RAS is 7.0. Many aquaculture species continue to feel comfortable in pH boundaries of 6.5-8.5. In the samples, taken from catfish rearing system, the pH varied from 5.58 to 6.63. Such acidic water decreases the effectiveness of biological filter, but also decreases the toxic effect of excreted ammonia on the fish. Only a small amount of suspended solid is present in the samples, which means that they are being removed properly. The average amount of ammonia nitrogen in the water basins in analysed catfish rearing systems is 1,171 mg/l. The analysed water samples presented an average nitrite amount of 0,974 mg/l. The recommended amount of nitrites for catfish is less than 0.5 mg/l. The analysed samples presented relatively high nitrate values – from 412 to 495 mg/l. In order to decrease the concentration of accumulated nitrates it is required to change no less than 10% of total system water volume every day. The index of consumed biochemical oxygen corresponds to the requirements for water quality in RAS.

**Keywords:** aquaculture, recirculating aquaculture systems, water, wastewater quality

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## The Effects of Tannic Acid on the Effectiveness of Egg Fertilization and Removing Carp Egg Adhesiveness

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### Abstract

Egg adhesiveness is one of the major problems in carp artificial breeding. The appropriate elimination of egg adhesiveness impacts the effectiveness of the breeding. This article discusses two used methods of carp egg adhesiveness removal: tannic acid+water and milk+water+salt solutions. Milk, water and salt solution was based on the following proportions: 1 litre of milk + 7 litres of water +50g of NaCl. Adhesiveness is removed from fertilized eggs in bowls by mixing them with geese feathers for no shorter than 60 minutes. The tannic acid solution was prepared by mixing 7 grams of tannic acid powder with 5 litres of water. 1 litre of solution is immediately poured into a bowl with fertilized eggs. Adhesiveness is removed from fertilized eggs in bowls by intensively mixing them for 10 minutes. After fertilization and removal of adhesiveness, the eggs were transferred into Weiss jars. The results showed that during the process of incubation, 3.7 million eggs were fertilized; out of them 1.6 million were rid of adhesiveness by milk solution, 2.1 – by tannic solution. It is plausible that unfavourable environmental conditions influenced the low egg vitality. 750 000 (47%) carp larvae hatched from milk solution treated eggs, while 800 000 (38%) of larvae hatched from the eggs treated with tannic solution.

**Keywords:** fertilization, adhesiveness, tannic acid, common carp

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## **Agropedogenic Transformation of Soils of Medium-dry Steppe Pedo-Ecotone in the Northwest of the Black Sea Region**

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### **Abstract**

The basis of all physical changes, occurring during agropedogenesis, is the transformation of the natural soil profile into the agrogenic soil profile. On the territory of the transitional zone from Gypsic Kastanozems to Calcic Chernozems (medium-dry steppe pedo-ecotone) in the northwest of Black Sea Region, the upper part of the soil profile, in the process of agropedogenesis is clearly divided into two horizons - cultivable (12-30 cm) and subcultivable (30-55 cm). Since the negative aspects of agropedogenesis are variously reflected both in the cultivable and in the subcultivable horizons, then, in our view, the transformation of the physical properties of the researched soils should be considered by comparing the properties of the cultivable and the subcultivable horizons.

The subcultivable horizons of the researched soils are characterized by a significant increase of cloddy type units content (by 50% in Calcic Chernozems and by 245% in Gypsic Kastanozems) and a decrease in the content of agronomic valuable aggregates (up to 7% and 31% respectively), in comparison to the cultivable horizons. At the same time, the cultivable horizons of the researched soils are characterized by a high dust content (<0.25 mm aggregate content is 17-60% higher than in the subcultivable horizons), which is the result of frequent plowing. Also, the subcultivable horizons are characterized by a decrease in the structural coefficient (by 20% in the Calcic Chernozems and by 74% in Gypsic Kastanozems) compared to the cultivable horizons. In turn, the cultivable horizons are characterized by a significant deterioration of water resistance characteristics of their structure. The water resistance criterion is reduced by 20-97% and the water resistance index is reduced by 9-56%, compared to the subcultivable horizons. Thus, the characteristic feature of the agropedogenic transformation of soils in the medium-dry steppe pedo-ecotone is its amplification from the east to the west and from the south to the north.

That is, the difference between the cultivable and the subcultivable horizons rises from Gypsic Kastanozems to Calcic Chernozems.

Consequently, the research results of the physical properties of soils in the medium-dry-steppe podoecotone indicate the negative impact of agricultural use on their most important indicators: deterioration of the structural state, decreasing of water resistance, increasing of cloddy type units content, deterioration of permeability and aeration, which leads to a decrease in the biological activity.

**Keywords:** Chernozems, Kastanozems, physical properties, agropedogenic transformation.

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## **Drip Irrigation as a Factor Mitigating Drought Impact in Corn Cultivation in Central Poland**

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### **Abstract**

The purpose of the research was to determine the effects of drip irrigation in corn production, depending on drought level classification in vegetation season. Corn is particularly useful for cultivation in the conditions of irrigation since its yield in central Poland depends significantly on rainfall distribution in growing season. Due to temporary water shortages losses in yield vary on average from 13% to 27%.

Corn was grown in central Poland under irrigation conditions in the years 2005-2016. The experiment was performed in Haplic Luvisol, representing IVa soil valuation class and very good rye soil suitability complex. The work uses meteorological data, carried out in a standard way, in accordance with WMO procedures, at the research station of the University in the vicinity of the experimental field. Based on the twelve-year effects of corn irrigation and meteorological data, the most relevant relationships between irrigation productivity and selected drought classification indices during the period of increased water needs of maize (from 1 June to 31 July) were searched. The

following indicators were taken into account: absolute precipitation, relative precipitation index (RPI), standardized precipitation index (SPI) and the ratio of precipitation to reference evapotranspiration. The results of the field experiment have shown that yield of irrigated corn dependent significantly on indices, which distinguishes drought levels (based mostly on rainfall conditions) and were characterized by a very high variability. Irrigation contributed to a significant increase in yield of 51% and to stabilization of yields in consecutive years. Under the influence of irrigation, the variability of yields decreased from 89% to 12%. The production effects of drip irrigation depended significantly on the drought monitoring indices during periods of increased water needs of plants, covering June and July. In humid seasons, the increase of yield obtained from irrigated plants was insignificant and about four times lower, while in dry seasons the increase was more than half higher than the average increase.

**Keywords:** drip irrigation, corn yield, drought, rainfall, evapotranspiration

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## Evaluation and Integration of Lithuania's Woodland Key Habitats

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### Abstract

In Lithuania, as well as throughout the world forest habitats are being rapidly degraded. Changes in forest structure, composition and functions have placed unwanted pressure on many species and even led to species extinction. In response, the woodland key habitat (WKH) initiative was created in 1993 by

Sweden. Using this example, Lithuania adopted the WKH initiative in 2004 and by 2005 had established a national network of WKHs. Using the initial establishment of WKHs from 2004-5 and the 2013 inventory we evaluated the changes in Lithuania's WKH network and assessed their contribution to forest protection. Results showed that between 2005-2013 89% of real WKH remained and 11% declined or were lost to harvesting. Of the potential WKH 28.4% became real WKHs, 44.2% remained as potential WKHs and 28.4% were lost. The data revealed that the reasons for WKH loss were mainly as a result of forest harvesting and incorrect identification in the first inventory. In general, the total area of WKH increased 9.8% because of establishment of new habitats including the conversion of potential WKH to real WKHs. However, 48.4% of potential WKH were lost to forest harvesting. In general, the decline in number of WKH has been offset by area gains in Lithuania. However, the loss of potential WKH for the future may be of concern. Although being very small in size (3.1/ha mean), WKHs can contribute to secure the functions and processes of forest landscape. The essential point is to find an effective way to manage and secure biodiversity long-term. WKH can provide one such avenue. However, policy, legal measures and on-going monitoring should be adopted to safeguard the future of the WKH network and their high biodiversity as formally protected areas.

**Keywords:** Biodiversity, conservation initiatives, ecological assessment, managed forests, protected areas, threatened species.

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## Methodological Approaches to the Valuation of the Lands at Change Their Water-Reclamation Status

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### Abstract

The article deals with new methodological approaches for the assessment of investment risks in the change of reclamation status of lands with peat fire. For the first time to ensure sustainable regional development developed an analytical model of evaluation of investment risks and, above all, environmental and social risks, restoring wetlands to reduce the risk of fire in the Ryazan region and utilization of greenhouse gases, taking into account possible changes in the environment on the territory of the Ryazan Meshchora.

**Keywords:** environmental management, sustainable development, wetlands, environmental services, investment risk, valuation of land

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## Soil Respiration in Stands of Different Tree Species

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### Abstract

Forest ecosystems of different tree species participate actively in climatic and biotic processes, such as photosynthesis, plant and soil respiration so knowledge especially on soil respiration such as CO<sub>2</sub> emissions to the atmosphere is of great importance. The aim of the study was to determine soil respiration rate of stands of deciduous (*Betula pubescens* Ehrh., *Quercus robur* L.) and coniferous (*Larix eurolepis* Henry, *Thuja occidentalis* L.) tree species as well as impact of abiotic (soil temperature, humidity, electrical conductivity and pH) and biotic (abundance of undergrowth, shrub, herbs) factors. Measurements of CO<sub>2</sub> emissions, temperature, moisture and electrical conductivity were performed in-situ in the stands of different tree species with portable ADC BioScientific LCpro+ system and digital electrochemical device "Wet" (Delta-T). Soil samples were collected for the physicochemical analysis simultaneously. Chemical analysis of soil samples were done at the lab of the Environmental Research of the Aleksandras Stulginskis University by standard methods. Soil respiration was highest in the stand of *Thuja occidentalis* and lowest in the stand of *Betula pubescens*. According soil respiration intensity in the ascending direction the stands as follow: *Thuja* < *Quercus* < *Larix* < *Betula*. In the coniferous tree stands, the soil respiration was lower on average 27% comparing to deciduous tree stands. Soil respiration rate from biotic factors was most influenced by abundance of herbaceous vegetation ( $r = 0.86$ ): as the herbaceous vegetation cover increased, the soil respiration rate also increased. The soil respiration was the most influenced by the abiotic factor – the soil temperature ( $r = 0.86$ ). The soil respiration rate increased with increasing soil temperature. Sixty year after planting, four stands of different tree species formed specific conditions which influenced soil respiration rate.

**Keywords:** Soil, respiration rate, CO<sub>2</sub>, deciduous trees, coniferous trees

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## Changes in Concentrations of Organic Matter in the Mouths of Dotnuvele and Smilga Rivers

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### Abstract

The quality of water in rivers of central Lithuania is often not good due to intensive anthropogenic activities. When rivers flow through the town's territory, concentrated pollution, such as rainwater, industrial and productional waste water discharges, contributes to diffuse sources of pollution. If biogenic substances are the main indicators for diffuse pollution, organic matter, expressed as BOD, is the indicator for concentrated pollution. The article provides the 2013 – 2017 monitoring data on the changes of organic matter in the water of Dotnuvele and Smilga rivers and discusses the reasons for fluctuations in concentrations of these substances. The aim of the research is to investigate the changes in the organic matter of Dotnuvele and Smilga rivers, depending on meteorological factors.

For chemical analysis, water samples were taken quarterly. Water analysis was carried out by the *ASU Chemical Analytical Laboratory of Water Resources Engineering Institute*. The amount of organic matter (BOD<sub>7</sub>) is calculated as the difference in oxygen content after 7 days of incubation, while the amount of dissolved oxygen (O<sub>2</sub>) in the water is determined by the electrochemical probe method. The concentrations of BOD<sub>7</sub> and O<sub>2</sub> in the water of both rivers is

compared with the criteria for assessing the ecological status of surface water bodies.

The research has shown that the dissolved oxygen concentrations in rivers' water are strongly influenced by water temperature and precipitation. The lower the temperature, the more of this element is found in rivers' water ( $r = -0.69$ ). A lower precipitation amount, which reaches the rivers, increases the amount of oxygen in them ( $r = -0.50$ ). The increase of BOD<sub>7</sub> concentrations in rivers' water was caused by higher precipitation amount ( $r = 0.46$ ), higher air ( $r = 0.41$ ) and lower water temperature ( $r = -0.41$ ). The ecological status of Dotnuvele and Smilga rivers was usually average.

**Keywords:** biochemical oxygen demand, dissolved oxygen, concentration, ecological state, surface water

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## **Impact of Natura 2000 Network on Investment Attractiveness of Polish Regions**

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### **Abstract**

The aim of this article is to evaluate the impact of Natura 2000 sites on the investment attractiveness of Polish poviats. Based on the literature review will be specified the indicators characterizing the investment attractiveness of poviats.

The authors intend to analyze the investment attractiveness in terms of labor resources, technical infrastructure, social infrastructure, microclimates market and administrative. Then, using the method TOPSIS it is calculated synthetic measure characterizing the investment attractiveness of poviats. In the next step, the authors intend to make a statistical analysis of the relationship between the investment attractiveness of Polish poviats and the presence for their areas Natura 2000. The results of the studies will be presented in the form of cartograms. This will be classify the 380 Polish poviats in 16 voivodships. The

basis for classification will be investment attractiveness, which will be used for cartographic visualization of the studied phenomenon.

The data for analysis will be obtained from the Local Data Bank of the Central Statistical Office.

The analysis proved that the occurrence of Natura 2000 areas in the examined territorial units does not currently have a significant impact on their level of socio-economic development.

**Keywords:** Natura 2000, Polish regions, socio-economic development, TOPSIS

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## **Characteristics of Scots Pine Growth to Climate Conditions in Different Pine Provenances Field Trial**

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### **Abstract**

Recently rapidly changing climatic conditions resulted in a rise of the new issues related to survival and growth of different Scots pine tree populations related not only to adaption to new climatic threats but also to mitigation to negative effects of the climate changes. Establishment of the experimental trials of pine trees provenance allowed to determine pine population best growing and most resistant to local environmental condition for ensuring the sustainable development of local pine populations in future. The aim of the

study was to detect the genetic adaptive capacity of pine population from neighboring as well as far distance geographic provenances, comparing tree survival and growth responses to climatic conditions in Kazlu Ruda 44 Scot pine provenances experimental trial. In 2013 dendrometric parameters of 10,613 trees growing on 8.65 ha area were measured and their location in the trial detected. Population from the central part of investigated area of pine distribution range demonstrated the highest possibility to survive in the local climatic conditions. Survival of trees from populations from most eastern and western parts of pine distribution range as well as from the most northern and southern parts was significantly lower. Notwithstanding this dendrometric parameters and volume per ha of western and southern provenances were close to the maximal values which demonstrated population from the central part of investigated area of pine distribution range.

**Keywords:** Scot pine, climate conditions, different provenances, growth response.

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## **Integrated Effect of Meteorology, Air Pollution and Surface Ozone on Crown Condition and Stem Increment of Scots Pine Trees under Different Site Conditions**

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### **Abstract**

Adaptation of the local tree species to recent environmental conditions rather often is found to be very low even when it affects tree health integrally with air pollutants, and surface ozone. The aim of the study was to quantify the relationships between environmental factors, annual stem basal area increment

and crown defoliation of Scots pine trees located in the north-eastern part of Lithuania. The obtained data revealed that Scots pine is the most sensitive species to environmental changes. Its reaction to both negative and favorable environmental factors was best expressed, what indicated its highest level of resilience and adaptive capacity to recent global changes. Air concentrations of sulphur species and ammonium as well as their deposition were the main drivers resulting in changes in mean defoliation of Scots pine trees in Lithuania. The data on stem basal area increment collected on two different forest sites (FS): mineral oligotrophic and organic mesoeutrophic soils confirmed that since the 1980 growing season the annual increment of the pine trees has increased. The causes of this rapid growth were as follows: higher air temperatures during the dormant period and, to a lower extent, the higher temperatures from May through August. The effect of precipitation was negligible. During vegetation nitrate deposition as fertilizing compound stimulated the pine tree stem BAI formation especially on mineral soil FS. Negative ozone effect on pine growth intensity was significant for pine trees on mineral soil FS. Higher moisture regime significantly increased the tolerance of pine trees to the negative effect of air concentration of acidifying compounds, their wet deposition and surface ozone.

**Key words:** Scots pine, defoliation, stem basal area, meteorology, acidifying compounds, ozone

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## Assessment of Water-Stable Soil Aggregation in Energy Crops Growing Locations

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### Abstract

Soil aggregation is a critical regulator of agroecosystem functioning. Formation of stable soil aggregates strongly depends on both the climatic conditions and the content of organic matter. Plant roots contribute to soil aggregate stability, directly through the root material itself and indirectly through stimulation of microbial activity in the rhizosphere. The purpose of this study was to determine the influence of seven different energy plant species – common osier (*Salix viminalis* L.), black poplar (*Populus nigra* L.), common mugwort (*Artemisia vulgaris* L.), cup plant (*Silphium perfoliatum* L.), virginia mallow (*Sida hermaphrodita* Rusby), cocksfoot grass (*Dactylis glomerata* L.) and reed canary grass (*Phalaris arundinacea* L.) on water-stable soil aggregation under natural climatic conditions. Investigations were performed in a long-term energy plants field trial at Vezaiciai Branch of Lithuanian Research Centre for Agriculture and Forestry situated in Western Lithuania. Perennial energy plant species were grown more than 8 years, in acid and limed soil without and with (N120) nitrogen fertilization. The soil of the study site is *Bathygleyc Distric Glossic Retisol* (WRB 2014) with a texture of moraine loam (clay content 13-15%).

The obtained research data showed that energy plants, depending on their physiological features and agrofonone, had different effects on the moraine loam topsoil aggregate composition and aggregates stability in water. Plant growth time and nitrogen have a significant influence on the development of plant roots and also on the formation of higher levels of both mezoaggregates and water stable aggregates. The largest amount of ecologically important mezoaggregates (5-0.25mm) and water-stable aggregates (> 0.25mm) were formed in soil with cup plants and slightly less in soils with common mugwort. Cocksfoot grass had a positive effect on the topsoil water-stable aggregate formation in limed and fertilized soil. The least valuable aggregates fractions were found in naturally acid unfertilized soil in virginia mallow growing location.

**Keywords:** soil, energy crops, water-stable aggregates, aggregation

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## **Groundwater Quality Dynamic in the Cleaned Former Pesticide Warehouse Territory**

**Laima Cesoniene, Kristina Lingyte, Daiva Sileikiene, Midona Dapkiene**  
Aleksandras Stulginskis University, Lithuania

### **Abstract**

Pesticides used in intensive farming help fight against pests and diseases of plants (insecticides, fungicides), kill weeds (herbicides), they also accelerate the ripening of seeds (defoliants); however, pesticides were stored in unsuitably constructed warehouses, were not controlled and accounted until 1992. This frequently resulted in pollution in the surroundings of a warehouse. These pollution spots are hazardous to the environment. Economic activity was carried out from 1980 to 1994 in this site. Various chemical materials for agriculture were stored and used in this territory. Later, in 1997, the chemical materials stored in the warehouse territory (fertilizers and chemical substances for plant protection) were collected and taken away. No chemical materials were found in the territory during the inventory taken in 2009. Unacceptable levels of pollution of soil and groundwater by pesticides and other toxic and neutral chemical materials were detected during the study carried out in the pesticide warehouse territory in 2010. In 2012 the polluted territory was cleaned, the remains of buildings were liquidated and the soil polluted by pesticides at an unacceptable level was removed. The objective of the study is to assess the impact of the cleaned former pesticide warehouse territory located in Bubiai village, Kaunas district municipality, on groundwater in 2012 – 2016. The results have shown that groundwater is polluted by nitrogen compounds the most; also, the tendency of increase in chlorides, sodium and calcium has been established. The concentrations of pesticides (DDD, DDE, DDT) have been established as minimal, with no change throughout the study.

**Keywords:** Ground water quality, pesticide, nitrates

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## **The Aspects and Benefits of the Activity of the Rural Development Measure Agri-environmental Protection**

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Aleksandras Stulginskis University, Lithuania

### **Abstract**

It is planned to ensure the balanced development of the country's territory, creating and maintaining a healthy and harmonious human habitat and natural elements of the countryside and ensuring overall ecological stability by means of the agri-environmental protection activity measures RDP. As part of the EU's rural development policy, the tool for improving agri-environmental and climatic conditions has been continuously improved. The paper analyzes the differences between the 2007 -2013 RDP measure „Agri-environmental payments” and 2014-2020 RDP measure "Agri-environment and climate". Comparison of the 4 directions of the 2007-2013 and 2014-2020 RDP measure "Agri-environment and climate" according to the individual criteria for each direction indicate that the program rules are adjusted in a beneficial direction for both parties in close cooperation between the responsible authorities and the beneficiaries. In 2007-2013 it has been established that RDP measure "Agri-environmental payments" covered a much wider range of directions, and in 2014-2020, the RDP measure "Agri-environment and climate" had a slightly narrower range of directions, but more specific and clearer rules. However, the



desired results can not be achieved. The main driving force for agri-environmental measures is financial support.

**Keywords:** rural development land use project, RDP, agri-environmental protection, climate, payments, measure, program, direction.

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## **The Local Parameters Sensitivity of Urban Hydrological Response Unit of Conceptual Hydrological Model METQ**

**Inga Grinfelde, Anda Bakute**

Latvia University of Agriculture, Latvia

### **Abstract**

The urbanised areas have significant impact on hydrological processes of catchment. The average annual urbanisation temp in EU is 0,6%. The existing version of conceptual hydrological model METQ is developed for natural hydrological response units such as forests, swamps and agricultural land. The growing urbanisation level force to ad to model urban hydrological response unit.

The aim of this study is to analyse local parameter sensitivity of urban hydrological response unit of conceptual hydrological model METQ.

The local sensitivity was made using MonteCarlo simulations. To evaluate local sensitivity Nash–Sutcliffe efficiency index (NSE), determination coefficient

R2, percent bias (PBIAS), ratios the root mean square error to the standard deviation of measured data (RSR) in addition to the graphical method were used.

The results show 7 parameters to be calibrated the other 16 parameters have to stay as constant for urban hydrological response unit.

**Keywords:** conceptual hydrological model METQ; parameter sensitivity; urban hydrological response unit.

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## The Measurements of Ammonia Emission from Agricultural Soils Using Cavity Ring Down Spectroscopy

**Inga Grinfelde, Laima Berzina, Kristine Valujeva**  
Latvia University of Agriculture, Latvia

### Abstract

The ammonia emissions from agricultural sector is one of key source of total national ammonia emissions. The direct measurements is one of methods to correct ammonia emission factor. The cavity ring down spectroscopy is relatively new technology to measure ammonia emissions. The measurement technology using closed chambers and GC do not allow to measure ammonia emissions with static chambers. The cavity ring down spectroscopy device Picarro G2508 record ammonia concentrations each second and chamber closure time is short.

The aim of this study is to estimate ammonia emissions measurement time using cavity ring down spectroscopy device Picarro G2508 with closed chambers. The 56 measurement sessions were made to calculate optimal measurement time. Chambers were closed for 20 minute and 1400 concertation measurements were made for each measurement point. The ammonia concentrations were used to calculate emissions with Soil Flux processor.

The results show that ammonia emissions can be measured using cavity ring down spectroscopy with closed chambers however closure time must be calibrated according to ammonia emission intensity.

**Keywords:** Picarro G25808; ammonia emissions; soil flux

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**Kristine VALUJEVA**, Scientific Laboratory of Forest and Wayer Resources, Faculty of Environment and Civil Engineering, Latvia University of Agriculture, Address: Akademijas str. 19, Jelgava, Latvia, LV-3001,

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## Analysis and Modification of Ordinary Waste Collection Systems

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Czech University of Life Sciences Prague, Czech Republic

### Abstract

The paper is focused on analysis of collected amount of two municipal waste commodities in order to obtain their higher volume in better quality, according to settings of collection system. Paper and plastic are commodities that can be used for material recycling and gain energy which is independent from original sources. The aim was to compare the values from three experiments and by using statistical methods to evaluate whether the modified system of waste collection achieves better results, especially the waste production and other measured parameters.

The paper presents processed analysis of three experiments, which were realized in selected municipality of Prague. In the first experiment was realized measuring of sorted waste amount of selected commodities applied on original collection system. The second experiment shows results of modified system of waste collection which was changed by moving vessels closer to the place of waste production, closer to the inhabitants of buildings. In the third phase is already modified system of waste collection upgraded by using marketing tools,

which are there to inform inhabitants how to minimize the volume of waste dropped in vessels.

Modifying system of waste collection proves increasing production of paper and plastic waste and also increases the motivation of inhabitants to place plastic and paper waste into vessels. The results are shown in monitored values as mass, volume and density of waste.

**Keywords:** waste collection, recycling, modification, analysis

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## The Volume of Wood Forest Resources in the European Union Countries

**Anna Turczak**

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### Abstract

The aim of the paper is to determine the influence of particular factors on the diversity of the European Union countries in terms of the amount of wood forest resources compared with the country size. Two factors affecting the variable have been analysed in the paper: 1) the growing stock per 1 hectare of forest area and 2) the quotient of the forest area and the land area. Those two variables are directly proportional to the dependent variable, thus the higher the growing stock density and the higher the forest cover, the bigger the amount of wood forest resources of the analysed country.



The logarithmic method was used to assess the influence of the deviations of the said factors on the deviation of the volume of wood forest resources in relation to the country size. Implementation of the method included the following calculation steps: a) constructing ratio equality (i.e. presentation of the ratio computed for the dependent variable as the product of the ratios computed for variables affecting the dependent variable), b) taking logarithms of both sides of the constructed ratio equality, c) dividing both sides of the obtained equation by the logarithm of the ratio concerning the dependent variable, d) and finally multiplying both sides of the equation by the deviation regarding the dependent variable.

The causal analysis allowed to answer the question how the two factors affect the variable considered in the twenty eight countries, namely, what the direction and the strength of their influence are. The average results obtained for the entire European Union were compared with those received for each country separately and final conclusions were drawn on this basis. Data for 2005, 2010 and 2015 have been used for all needed computations.

**Keywords:** wood forest resources, forest growing stock, forest cover, the European Union

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## **Comperatyve Studies Of The Significance Of Competition Indices And Genetic Diversity Of Scots Pine Trees On Their Reaction To Changes In Meteorology And Air Pollution**

**Marius Mikalajūnas, Giedrius Šidlauskas, Edgaras Linkevičius**  
Aleksandras Stulginskis University, Lithuania

### **Abstract**

The aim of this study was to detect the significance of the ocompetition index vs. genotype of Scots pine trees to thier reactions to changes in meteorology and air pollution. Tree health, dendrometric parameters and stem basal area increment were chosen as response variables to meet the objectives of the

presented study. The investigation was carried out at Scots pine genetic stand located in Aukštaitija national park, Vaišniunai district. Data on meteorology and air pollutants were obtained from ICP Integrated Monitoring Station located there. Genetically related individual groups in the stand were established by the neutral part of the genome of short repeated DNA sequence length polymorphism markers. Trees of distinctive short repeated sequences allele frequencies were grouped by Bayesian cluster analysis methods. Six competition indices based on relative crown parameters, such as tree crown horizontal and vertical projection area m<sup>2</sup> were used to determine significance of the competition intensity to the tree increment and their dendrometric parameters including crown health in general. The obtained results revealed that trees which demonstrated the most intensive radial growth, best crown condition and the most significant reaction to changes in meteorology and air pollution comprised the separate trees genetic group while trees with adverse characteristic - another. Notwithstanding this multiregression analysis revealed that competition intensity had more significant effect on BAI formation and tree dendrometric parameters in general than tree genotype. The study is based on the results obtained conducting national project supported by Lithuanian Council of Research “FOREstRESS” (SIT- 3/2015).

**Key words:** Scots pine, genetic group, competition index, crown defoliation, dendrometric parameters, radial increment, air pollution.

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## The Measurements of Ammonia Emission from Agricultural Soils Using Cavity Ring Down Spectroscopy

**Inga Grinfelde, Laima Berzina, Kristine Valujeva**

Latvia University of Agriculture, Latvia

### Abstract

The ammonia emissions from agricultural sector is one of key source of total national ammonia emissions. The direct measurements is one of methods to correct ammonia emission factor. The cavity ring down spectroscopy is relatively new technology to measure ammonia emissions. The measurement technology using closed chambers and GC do not allow to measure ammonia emissions with static chambers. The cavity ring down spectroscopy device Picarro G2508 record ammonia concentrations each second and chamber closure time is short.

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The results show that ammonia emissions can be measured using cavity ring down spectroscopy with closed chambers however closure time must be calibrated according to ammonia emission intensity.

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## The Local Parameters Sensitivity of Urban Hydrological Response Unit of Conceptual Hydrological Model METQ

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### Abstract

The urbanised areas have significant impact on hydrological processes of catchment. The average annual urbanisation temp in EU is 0,6%. The existing version of conceptual hydrological model METQ is developed for natural hydrological response units such as forests, swamps and agricultural land. The growing urbanisation level force to ad to model urban hydrological response unit.

The aim of this study is to analyse local parameter sensitivity of urban hydrological response unit of conceptual hydrological model METQ.

The local sensitivity was made using MonteCarlo simulations. To evaluate local sensitivity Nash–Sutcliffe efficiency index (NSE), determination coefficient R<sup>2</sup>, percent bias (PBIAS), ratios the root mean square error to the standard deviation of measured data (RSR) in addition to the graphical method were used.

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## The Anthropogenic Air Pollution Source Identification in Urban Areas Using Snow Sampling

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<sup>1</sup>Latvia University of Agriculture, Latvia

<sup>2</sup>Latvia University, Latvia

### Abstract

The anthropogenic sources of air pollution such as transport, energetics, household heating and industry generate different trace element footprint. The urban planning is one of tool to reduce air pollution with trace elements.

The aim of this study is to identify air pollution sources in Jelgava city using trace elements. The snow sampling were collected during January and February 2017. The January snow samples characterize average Jelgava city air pollution however February characterise intensive tourism impact on total air quality of Jelgava city.

The snow samples were analysed using inductively coupled plasma spectrometer (ICP-OES).

The data analysis consist of three stages. First, data verification and development of transport, energetics, household heating and industry typical pollution trace element data sets. Second, the cluster analysis of each data set, by developing three groups of pollution level for each pollution source. Third the results of clusters were analysed using GIS and the areas with different air pollution sources were identified.

The results show strong evidence of transport and household impact on air quality.

**Keywords:** inductively coupled plasma spectrometer (ICP-OES); anthropogenic air pollution

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## Long-term Groundwater Regime Trends in the Agricultural Areas

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### Abstract

Long-term data on hydrological regime change of the groundwater situated in moraine sandy loam and peat soil in Lithuanian karst zone presented in the article. The aim of the paper is on the basis of long-term groundwater studies to determine the water level trends.

Groundwater level fluctuations mainly dependent on the ground type. The nearest land surface groundwater level (61-174 cm) was measured in peat soil (well 1), in mineral soil (well 2) was deeper (309-584 cm). Correlation between data of the annual precipitation and groundwater level in mineral soils ( $r^2=0.416$ ,  $t_{act}=3.48 > t_{95\%}=1.74$ ) was more significant than in peat soils ( $r^2=0.185$ ,  $t_{act}=1.96 > t_{95\%}=1.74$ ). The widest fluctuations of groundwater level occurred in mineral soil (well 2). According to Mann-Kendall test the groundwater level significantly increased in February, April and December. In winter the thickness and duration of seasonal freezing decreases, frequent thaw increased feeding of the aquifer.

**Keywords:** groundwater level, karst zone, mineral soil, peat soil.

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## The Opportunities and Challenges of Using Airborne Laser Scanning for Forest Inventories in Lithuania

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### Abstract

The aim of this study was to test the usability of airborne laser scanning (ALS) data for stand-wise forest inventories in Lithuania based on operational approaches from Nordic countries, taking into account Lithuanian forest conditions and requirements for stand-wise inventories, such as more complex forests, unified requirements for inventory of all forests, i.e. no matter the ownership, availability of supporting material from previous inventories, high accuracy requirements for total volume estimation. Test area in central part of Lithuania (area 2674 ha) was scanned using target point density 1 m<sup>-2</sup> followed by measurements of 440 circular field plots (area 100-500 m<sup>2</sup>). Detailed information on 22 final felling areas with all trees callipered (total area 42.7 ha) was made available to represent forest at mature age. Updated information from conventional stand-wise inventory was made available for the whole study area, too. A two phase sampling with nonparametric Most Similar Neighbor estimator was used to predict point-wise forest characteristics. Total volume of the stand per 1 ha was predicted with an root mean square error of 18.6%, basal area - 17.7%, mean diameter – 13.6%, mean height – 7.9% and number of tree - 42.8% at plot-level with practically no significant bias. However, the root mean square errors increased 2-4 times when trying to predict forest characteristics by three major groups of tree species – pine, spruce and all deciduous trees taken together. Main conclusion of the study was that accuracy of predicting volume using ALS data increased notably when targeting forest characteristics by three major groups of tree species.

**Keywords:** forest inventory, laser scanning, compartment, stand volume

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## **Integrated Effect of Climate and Air Pollutants on Diurnal Tree Ring Formation of Scots Pine, Norway Spruce and Silver and Downy Birch Trees Stem Circumference**

**Ainis Pivoras, Marius Mikalajūnas, Diana Juonytė, Gintaras Pivoras**  
Aleksandras Stulginskis University, Lithuania

### **Abstract**

The integrated effect of climatic and other abiotic stress factors including surface ozone on diurnal tree ring width formation of the prevailing in Lithuania tree species as the main response parameter of tree capacity to adapt to and mitigate the recent global changes was investigated. The obtained data revealed that Norway spruce is better adapted to recent climatic conditions in temperate forest than birch trees. Even during the drought episode spruce stem increment exceeded increment of the rest of considered tree species. Silver and Downy birch tree reactions revealed the lowest sensitivity of these tree species not only to unfavorable environmental factors but also to favorable factors which should stimulate tree growth intensity. This is why the growth intensity of this tree species recently has been gradually decreasing. The hypothesis that the coniferous species are more adaptive to recent climate changes was confirmed. The study is based on the results obtained conducting national project supported by Lithuanian Council of Research “FOREstRESS” (SIT- 3/2015).

**Key words:** diurnal rate, tree ring, swelling, shrinking, meteorology, ozone

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## **Factors Influencing Agricultural and Household Land Market**

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### **Abstract**

The article analyzes private land sales in Lithuania during 2015-2016. The aim of the research is to determine the intensity of land sales and the reasons affecting land market prices. Objects of research were farming lands and household plots.

Accomplished regression analysis has shown that the size of towns located in the municipality, and the portion of land owned by legal persons in the entire private agricultural land area affect the agricultural land market activity, whereas the market price is affected by the land economic value, land use intensity and size of towns located in the municipality. The size of towns located in the municipality and housing indicators of population affect market activity of land plots purchased for housing. Land prices of household plots in towns are influenced by the size of the town, the distance from a major regional center and the town's population stability.

**Keywords:** private land, land market, agricultural land, households plots.

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## **Land Use and Planning in Rural Areas (A Case Study of Giedraičiai Subdistrict)**

**Jolanta Valčiukienė, Virginija Atkocevičienė, Daiva Juknelienė**  
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### **Abstract**

The rational use of land should be ensured, soil-friendly agricultural branches should be developed as well as attractive environment for work, living and resting in the countryside should be created in promoting rural development in Lithuania. Areas with favorable natural conditions have a high degree of economic activity, farm size, and economic development. However, not everywhere the natural conditions for the development of agriculture are favorable. The research was carried out in the Giedraičiai rural area of Molėtai district, which deals with the factors influencing the use of land, the declared area of land, the problem of land abandonment. The methods of legal analysis, analysis of literature, analysis, comparison and aggregation of statistical data were used during the research. After the fulfilment of the analysis of the declared area of land during the period between the years 2012 and 2016, it was established that the area of agricultural land declared during the five years increased by 655 hectares, the number of farmers who declared agricultural land decreased by 104, and the number of declared parcels declined even to 1729. The process of the growing of farms is likely to occur. The area of abandoned land in Giedraičiai subdistrict reaches 300 hectares, the number of abandoned areas exceeds 800. Estimating the statistical data and solutions of the general plan of the Molėtai district area preliminary solutions for the management of the territory of the Giedraičiai subdistrict for agriculture and rural development are being provided, i.e. it is planned to implement rural development land management projects for the management of farms, and to select a farmhouse farm site. To reduce the abandoned land areas, it is advisable to plan forests, expand the areas of meadows and natural pastures, apply organic farming and adapt the areas for recreation.

**Keywords:** land use and planning, agricultural land, rural development, preliminary solutions.

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## How Giant Pedunculate Oak *Quercus robur* Trees Survives in the Clearcuts ?

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### Abstract

We studied giant ( $D_{1.3m} > 60$  cm) Pedunculate Oak *Quercus robur* trees left in the clear cut logging sites. The aim of the research – to analyze the status of oaks after it's retention in the clear cut logging sites. We defined their patterns of death and made recommendations to increase tree survival rate.

The field data was collected about the status of oaks and environmental changes in the clear cut sites. After 9 years 27% of giant oaks died in the former logging sites. The rate is affected by the development class of tree, ratio of tree canopy with height. Better survival rate had trees which in tree stand were A' class graded and had wider canopy. The age of surrounding stand had effect to the trees also. Better survival rate had trees grown in younger and higher stocking level trees stands. Lower survival rate had trees grown in 100 years and older tree stands with low 0.3-0.5 stocking level. Better survival rate had trees grown with spruces and birches as well as opposite - grown with oaks, alders and aspens. Impact to the tree survival had the distance from skidding trail to the

tree and onsite soil mechanical damage. The greater soil damage and closer they are to the left trees, the greater part of trees were dying.

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## Temperature Field Distribution Character in the Upper Soil Layer Under Water Steam Treatment

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### Abstract

After sowing of cultivated plants, there are many weed seeds spread in crumbled intermittent. At the beginning of vegetation weeds overcome cultivated plants and create competition. Their vitality can significantly been reduced by treating upper soil layer with wet water steam. The aim of the research is to determine the character of temperature field's distribution and its intensity in the upper soil layer of intermitten.

The experiments were carried out using (Calc (or) i-EpihypoglevicLuvisol, LVg-p-w -cc (sc), an ore-rich soil passed through a 17 mm sieve. The character of temperature field distribution and their intensity in the upper soil layer are fixed by 0.19 mm diameter nickel-chromolete copper-temperature sensors, placing them according to pre-prepared measuring schemes in the measuring planes. The changes of temperature field are registered with the Almem device. The results of the research showed that the character of the temperature fields distribution and its intensity in the upper soil layer depend not only on the type of soil, its density, moisture and the initial temperature, but also on the duration of the treatment using wet water steam, the amount of water steam supplied to the upper soil layer and the amount of overpressure. The results of the research carried out make it possible to add one more technology to the general technology of weed control using wet water steam - the thermal destruction of weed seeds in the upper soil layer.



**Keywords:** Thermal weed destruction, weed seeds, upper soil layer, temperature field, distribution pattern, spreading intensity.

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## Selected Determinants of Multifunctional and Sustainable Development of Rural Areas with Increased Natural Hazards in Poland

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### Abstract

The strategy of multifunctional and sustainable development of rural areas is based on three integral pillars related to social, economic and environmental policy. Directions and the rate of changes in the development of rural areas are determined, among others, by the range of local community needs, including those related to public security and economic capital. Modern times abound in various types of hazards, those of a technological, military or terrorist nature, but also those resulting from extreme natural phenomena, which include intense precipitation, lightning, snow melting or strong winds, contributing to e.g. floods, landslides or fires. The study identifies present-day factors determining multifunctional and sustainable development of rural areas at risk of natural hazards.

**Keywords:** determinants, natural hazards, rural area



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## **Land Use Planning in the context of the Responsible Governance of Tenure**

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### **Abstract**

Modern land management should be based on, in particular, Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security adopted by the United Nations. It is imperative that the system of land administration functions and methods are taken into interconnected and complex process (records of tenure rights, valuation and taxation, regulation, etc.), but it is particularly important to ensure the openness of the land use planning system. Purpose and objectives of the article is to analyse the experience, identify problems and devise measures to improve the situation.

A variety of methods were used in scientific research, that allowed to make certain conclusions and formulate proposals.

**Keywords:** Land Use Planning, Responsible Governance of Tenure, National Food Security

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## Input of Collective Lands to Sustainable Development of the Rural Population: Study Case of Northern Portugal and Galicia

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### Abstract

Collective lands occupy about 1 million hectares in the Northwester of the Iberian Peninsula with average areas high (500 ha in Portugal and 200 ha in Galicia). The region is among the poorest in the European Union (EU) with a lower Gross Domestic Product (GDP) in comparison with most developed European regions. During centuries, '*Baldios*' in Portugal and '*Montes Veciñais en Man Común*' (MVMC) in Galicia played an essential role in the economy of their owner communities. This function was lost during the twentieth century due to the massive forestation with fast-growing species and the decline of agriculture. The restoration of democratic regimes in both countries returned the baldios and MVMC to the communities, now declining, aged and disorganized. Taking into account the extension of the communal lands and their large average size, this paper aims to determine the potentialities and limitations, in the current conditions, of collective lands contribution to rural development. Two case studies, one in North Portugal and another one in Galicia, allow identifying the still traditional individual and collective uses and the accomplishments made with revenues to these lands. Both Galician and Portuguese realities exhibit similarities and complementary benefits, and requiring social innovation to make a better use of rural resilience. Communal lands and small-scale projects initiatives can support the network of local produce markets with attractive aesthetic values as well as biodiversity conservation. The comparison of the criteria shows that economics aspects are the most valued; however, environmental aspects are somewhat less valued by stakeholders. The decision for the management of communal lands in northwest Iberian Peninsula was the alternative "mixed" by the communities and the Forestry Services as the best one to fulfil the general objective of sustainable rural development. As a conclusion of our work, remarking the communities owning the common lands currently seem to have the conditions to manage their properties if the commoners are able to mobilize and organize the communities.

**Keywords:** Baldios; Montes Veciñais en Man Común; communal property; rural resilience

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## Comparison between high forest management and coppice forest in natural stands of *Quercus robur* L. in Galicia (northwestern Spain)

**Ignacio J. Diaz-Maroto**

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### Abstract

The coppice forest has been the most used treatment in the ‘*carballo*’ (*Quercus robur* L.) forests in Galicia given its ability to regenerate from stump shoots and root. However, the scarce utilize of firewood and charcoal vegetal now, makes this type of use is being abandoned.

The *Quercus* forests are the climax vegetation that should cover most of the Galician area. Today, much of their potential area is occupied by fast-growing tree species, large pasture and land dedicated to agriculture. Oak forests (*Quercus robur*) occupy an area about 250,000 ha in Galicia, 18% of the total forestry area. Without adequate forestry management, much closed stands do not allow the natural regeneration development. A positive aspect is currently these ecosystems have high environmental importance, being recognized as habitats of Community interest to be part of the NATURA 2000 network. The aim is to propose a set of silvicultural treatments for recovery and conservation of these forests. The study focused on the progression of the natural hardwood forests, mainly *Quercus* forests, intensely exploited since antiquity. These oak forests were: i) converted to agricultural land; ii) felled for the naval, metallurgical and railway industries; iii) joined with Church belongings; iv) suffered and continue to suffer from wildfires; v) replaced by fast-growing species, mainly coniferous and now *Eucalyptus nitens* Shining Gum. All these activities led to a reduction in the area occupied by them. Now, these forests occupy the great area for several centuries. Broadleaved forests cover small and sloped sites, remaining where its location often avoided other land-use type. Also, can be found in flat areas close to villages but the natural regeneration is limited by human activities. Results indicate that these steep sites have a highly modified landscape with a slow transformation where the biodiversity

conservation, the hunting and the cultural or environmental tourism have a high importance. So their state raises the problem of their socioeconomic transformation.

**Keywords:** Forest management; high forest; coppice forest; *Quercus robur* L.

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## Factors Influencing Changes of Beef Cattle Herd Quantity and Size: Case Latvia

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### Abstract

Beef production volumes in the Latvia have been different over a long period of time, where was noted the beef output growth, as well as a sharp decrease, so it is important to analyze what are the most important beef production volumes affecting factors that will give an idea of the possibilities for beef market regulation. Consequently, it can be defined the study objectives: Identify factors affecting beef production in Latvia.

For research was used statistical methods, correlation analysis, induction, deduction, analysis and synthesis. The methods used gives an accurate picture of beef production volumes affecting factors.

Based on research results can be concluded that beef production volumes are significantly affected by factors such as demand for beef and the available EU and national subsidies for beef producers.

The research results point to the fact that Latvia beef production volumes not only affect the market demand, but also Latvian government and EU subsidies for beef producers, which is a powerful instrument for beef production regulation. Using subsidies to regulate market, the Latvia can achieve beef production volume growth as well as cuts. This market regulation has an impact on beef sales price, which refers to the possibility for consumers to purchase beef products and also affects beef export opportunities to and outside EU

**Keywords:** subsidies, beef demand

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## **Changes in the profitability of farms in European Union member states – convergence or divergence?**

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### **Abstract**

This paper aimed at evaluating the differences within the European Union (EU) regarding profitability of farms and answering the question whether in 2007-2015 any trends at convergence of their income position occurred between member states. The survey covered farms maintaining farm accounts under FADN (Farm Accountancy Data Network) in 27 member states of the EU. Convergence was evaluated based on the coefficient of variation (sigma convergence) and the relative index of variation in respective member states of the EU in comparison to the EU average in the analyzed period (beta convergence). The surveys point to large disparities in the level of profitability between farms in European Union member states. The highest profitability of work was recorded in countries such as Luxembourg, Netherlands, Ireland, Italy and Belgium. In all new member states the analyzed ratio was relatively low and none of them exceeded the average level for the EU. In 2015 the lowest profitability of land was characteristic of Slovakia, Estonia and Denmark, whereas the highest income per 1 ha was achieved by agricultural producers in Malta, Italy and Greece. In the analyzed period no clear trends were observed in convergence or in profitability of work or profitability of land, which means that inequalities between countries with a different level of agricultural development did not disappear.

**Keywords:** convergence, European Union, farms, income

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**SOCIAL INNOVATIONS FOR RURAL  
DEVELOPMENT**



## **Agriculture's Impact for the Economy: Inter-industry Linkages and Multiplier Effects**

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### **Abstract**

The role of agriculture sector is understood as being vital for economic development and well being of rural areas. Common agriculture policies in the EU and production shocks in agriculture sector reflect in production changes that causes direct and indirect effects for other industries development in the region, as well as, households' income. This paper aimed to evaluate agriculture sector's direct and indirect impacts for the economy by analyzing sectoral linkages and multiplier effects. Input-output analysis techniques were applied. Sectoral and household income multipliers were evaluated. This paper supports the idea that agriculture sectors were more multiplying the economy than other sectors on average. This sector remains important role catalyzing the economy that is very important while taking into account development challenges in rural areas.

**Keywords:** agriculture, input-output analysis, multiplier effects

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## **Dual-use Research and Technology of Concern: Increase of Risks in Modern Life Science and Globalization of Bioethics**

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### **Abstract**

Modern life sciences represent the sphere of natural and exact sciences, which include scientific research of living organisms such as microorganisms, plants, animals and human beings. For example modern biology spreads quickly in such spheres as robotics, computer systems, psychology, linguistics and



different social subjects, giving rise to new promising directions and interdisciplinary spheres. At the same time a number of researchers mark that technical-technological possibilities of changing fundamental basics of existence of humans and nature are being created. The article based on the analysis of tendencies of development of the technology and recent discussions about dual- use research and technology of concern, justifies the increasing role of bioethics. Of particular concern is received wide spread production and use of genetically modified organisms (GMOs), carrying a serious risk for human and animal health, biological diversity on the planet. This requires special mechanisms and prevention, such as humanitarian expertise and bioethics. This is due to the fact that the high rate and intensity of development of science and technology have created conditions of uncertainty, lead to increased risks to life and human welfare, the sustainable development of society and nature. It has been suggested that regulation of these risks at the global level, which in turn emphasizes the growing global nature of bioethics.

**Keywords:** dual-use research and technology of concern, modern life science, tendencies of development of science and technology, risks, bioethics.

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## **Cluster Approach to Agriculture Education in Russia by the Example of the Republic of Tatarstan**

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### **Abstract**

In modern conditions of rural development the most important productive resource of the agrarian company is human capital. Only well-trained, receptive to innovation, adapted to the market economy, the technician can solve

problems for the effective implementation of the economic activity of any enterprise. However, in recent years the problem of staffing is both a management and staff machine operators have intensified. Numbers have fallen substantially, increased the load on one specialist. Inadequate salaries and general social problems in rural areas of Russia and Republic of Tatarstan reduce the attractiveness of work for graduates of agricultural education institutions.

The main methods used in this study are comparative theoretical-methodological research of educational institution and logical analyze agricultural education in Russia. The article discusses and analyzed the positive experience of scientific and educational cluster of agro-industrial complex of Republic of Tatarstan and Kazan State Agrarian University. One of the important conditions to solve some of the problems facing agriculture of Russia today, is the modernization of the agricultural education is associated with the formation of relevant scientific, scientific-educational and scientific-production platform. The progressive development of human potential of the agricultural sector plays an important role in achieving the designated high results as the main carrier of innovative knowledge and skills, without which the introduction of modern methods and technologies in production and management of enterprises of agro-industrial complex is simply impossible. Staffing issues agriculture is of great socio-economic importance and is the most important priorities of the state policy not only at present but in the future. Identified key staffing problems of the agro industrial complex of Russia and Tatarstan. Designed and proposed a new intensive model of development of scientific-educational cluster of agro-industrial complex of Republic of Tatarstan.

**Keywords:** agriculture, scientific-educational cluster(SEC), innovation, education, human resources, agro-industrial complex (AIC) of Republic of Tatarstan (RT), science-educational complex (SRC), Kazan State Agrarian University.

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## What Determines Propensity to Get Public Investment Subsidies? A Case Study of the Czech Food Industry

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### Abstract

The aim of the paper is to quantify differences in structural and economic indicators between participants and nonparticipants of the investment support programmes in the Czech food industry at the beginning of the old programming period (2007). Research was conducted on a dataset of supported projects from the Ministry of Agriculture and Ministry of Industry and Trade combined with structural and economic indicators of participating and nonparticipating companies provided by MagnusWeb database. Final database contained 1 225 companies. However, not all indicators were available for all companies. Original set of variables was selected through Principal Component Analysis. Propensity to be supported was calculated through probit regression. Public investment support has had pretensions to increase productivity of the food industry as well as the added value of agricultural production by supporting many operations in agricultural processing and marketing. Ex-post evaluation of the “old” programming period 2007–14 shows that companies with larger size, lower trade margin, optimal liquidity, lower debt ratio and higher credit debt ratio had higher propensity to be supported. Conclusions about size and credit debt ratio follow previous research by other authors that small companies had lower chance to be supported because of more difficult access to good advisory services and bank loans.

**Keywords:** investment support, food technologies, impact assessment

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## Population Density in Rural Areas as a Driver of the Human Capital Development

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### Abstract

Rural areas are typically characterised by uneven access to education and the resulting varying levels of pupils' educational attainment. The inefficiency of the education system may lead to a decreased level of human capital development in the society. It is therefore vital to identify the factors responsible for the inefficiency of the education system and take steps to mitigate their negative impact.

The aim of the present study is to determine the relationship between the population density in rural areas, the pupils' average level of examination performance and the educational value added.

The analyses were based on the exam results achieved by lower secondary school-leavers in 1,372 rural communes between 2012 and 2014. The original intention was to include all rural communes in the analysis. However, due to the incompleteness of the data concerning some of the communes, they were eventually excluded from the study. The final sample for analysis consisted of about 58% of all rural communes in Poland.

The communes were divided into classes, based on the criterion of population density. The objects under study were arranged in an ascending order according to the value of the population density variable, and then divided into four classes (class A contained 25% of communes with the highest population density).

The classes thus defined were used as a qualitative predictor in the subsequently performed ANOVA test. As a next step, contrasts were determined by applying a simple contrast to the analysed classes of communes.

The analyses revealed that the highest examination results were achieved in the communes with the highest population density, while the lowest examination results were found in the communes with the lowest population density. This dependence may be indicative of educational negligence at lower levels of education, in this particular case - at the stage of primary school.

The results of the analyses point to the need for expanding the network of nursery schools. To address the above problem, financial support should be provided from the state budget to social initiatives aimed at increasing the

access to nursery schools, e.g. by creating an appropriate system of subsidies for nursery schools run by both local governments and private entities.

**Keywords:** ANOVA, educational effectiveness, human capital, rural areas, educational diversification

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## Economic Rationale for Protected Geographical Identification Introduction for Latvian Canned Sprats

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### Abstract

The article raises the question of economic rationale of including Latvian sprat to the protected geographical identification (GI) register of the European Commission. GIs aims to address the situation of asymmetric information on the market specifically a situation when high-quality foodstuffs customers' loyalty and trust can be jeopardized by presence of sub-optimal products. One of the means to help customers and producers confront the information asymmetries and possess more control over the situation is the institute of trademarking. GIs can be understood as a type of trademarking, however, since the GI does not belong to a single company but rather to a product and is used by many companies simultaneously, the GIs are rather seen as a type of collective monopoly right reinforcing collective responsibility of producers. **The aim of the present research** is to evaluate theoretical and economic background of GI-labelling and possibilities for GIs introduction to canned sprat industry in Latvia. According to the economic theory, a number of acute problems in the canned sprat industry in Latvia can be resolved by participating in the GI scheme and protecting the traditional producing of Latvian sprat at the European level. Latvian canned sprats is one of the food stuffs that can be eligible to obtain a GI-labelling and would benefit from the certification both in

the local market and exported. The key structural events to be mobilized to realize the potential of a GI-labelling introduction to the canned sprats sector in Latvia are indicated in the article along with the GIs theoretic introduction and discussion.

**Keywords:** canned sprats, high-quality added value foodstuff, Protected Geographical Identifications

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## Assessment of Value Added Tax Reduction Possibilities for Selected Food Groups in Latvia

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### Abstract

Value-added taxes (VAT) are applied in the European Union (EU) Member States in accordance with Directive 2006/112/EC to limit distortions in competition in the common European market. Latvia is one of the five EU Member States where reduced VAT rates are not applied to food products, and the food is taxed at the standard rate of 21%. For this reason, food producer organisations discuss the introduction of a reduced VAT rate for selected fruits, berries, vegetables as well as potato grown in Latvia. **The overall aim of the present research** is to assess the effect of reduction of the VAT rate from 21% to 5% for selected food groups: fresh fruits, berries, vegetables and potato produced in Latvia. The research estimated a decrease in the price for the mentioned food groups, identified a potential increase in consumption and forecasted the effect of the VAT rate reduction on the amount of tax revenue collected by the central government. The research found that the reduction of the VAT rate from 21% to 5% would result in a price decrease ranging from 1.9% to 3.5% for fruits, berries, vegetables and potato, the consumption of fresh fruits and berries would increase, on average, in the range of 1.2-2.3%, while the

consumption of fresh vegetables would increase, on average, in the range of 1.2-2.1%, yet in a short-term the tax revenue paid to the government would decrease in the range of EUR 3.9-5.7 million. Nevertheless, in a medium-term, a significant positive effect on the producers of fruits, berries, vegetables and potato that operate legally in the agricultural industry could be expected, as the negative effect of the shadow economy decreases.

**Keywords: value added tax, prices, consumption, government budget**

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## **Role of the Internet in Strengthening Social Capital in EU Rural Areas**

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### **Abstract**

The article discusses the role of the Internet as an innovative form of interpersonal communication. The article uses the information gathered during literature studies, reviewing the publications devoted to the subject. Research conclusions are presented synthetically, including by means of graphs, to pave the way for analysing the data obtained from EUROSTAT and GUS. The statistics illustrating the assumptions behind the paper relate, among others, to the number and structure of agricultural holdings in the EU, the age of their owners and the selected attributes describing the use of electronic media and the Internet in Poland. We assumed that Internet usage in rural areas may not only result in better access to knowledge and information, but also contribute to stronger social cohesion and prevent exclusion of the elderly. We analysed information about individual Internet users in Poland and the EU, including changes related to age, education and domicile. The data enabled us to identify

expected change tendencies in rural areas. We highlighted the process of ageing of European farmers with its related social and economic consequences. Against this background, we show the dual role played by the Internet in strengthening social capital in rural areas. On the one hand, it is educational in that it educates and activates young farmers. On the other, it is social, i.e. it helps the elderly stay in touch and participate in social life. We also raised the problem of potential digital exclusion of the elderly.

**Keywords:** social capital, the ageing of European farmers, the role of Internet, potential digital exclusion of the elderly

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## **Effectiveness of the Investment Activity of Polish Communes in the Context of the Bioeconomy Development**

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### **Abstract**

The purpose of this paper was to evaluate the efficiency of investment activity in the communes in Poland. The commune is a basic unit of local government in Poland, and rural and urban-rural communes constitute the vast majority of municipalities. Communes in their own name and on their own account carry out public tasks that cover all tasks of local interest, including technical and environmental infrastructure. The nonparametric method of technical efficiency Data Envelopment Analysis (DEA) was used in the study. The inputs and the effects of investment activity of rural and urban-rural communes in 2007-2013 were compared. This period was related to the duration of EU support programs. The study was conducted on the basis of data from the Local Data Bank which is Poland's largest database of the economy, society and the environment. The ranking of investment activity for communes were made based of the calculated average for indicators of efficiency. The studies conducted show that the



amount of expenditure incurred on the studied spheres of investment activity of the analyzed communes does not translate into their effectiveness. This is connected with the possibility of obtaining additional funds from EU. Information on the use of EU funds for financing the municipal investments were not included in the study due to lack of data before 2010. Among the analyzed rural and urban-rural communes the most effective ones were located in the Mazowieckie, Świętokrzyskie and Lubelskie voivodships, although they were not fully effective throughout the considered period. Due to its closeness to the capital, the municipality of Mazowieckie voivodeship belongs to an area with a high degree of urbanization. Communes from the Świętokrzyskie and Lubelskie voivodships belong to regions characterized by a high share of rural areas. The dynamic development of infrastructure is extremely important in terms of divergence between regions of the country.

**Keywords:** bioeconomy, communes, effectiveness, investments

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## **The Potential of the European Union Countries to Produce Biomass for Biodiesel Production and Consumption Purposes**

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### **Abstract**

This article aims at evaluating the capacity of agriculture in the member states of the European Union regarding the production of biodiesel from biomass as well as identification and empirical verification of relationships between the rapeseed market and the consumption of biodiesel. The studies were based on panel data for EU-28 member states in the period 2010-2013 obtained from Eurostat. The results of the studies point to significant differentiation in the production and consumption of biodiesel and its share in the consumption of

liquid fuels in the transport sector in the EU. This article proposes the construction of a theoretical model describing the relationship between the consumption of biodiesel and the key determinants of its production. The studies carried out show that the variable having the strongest impact on the consumption of biodiesel in the countries of the EU is the price of rapeseed (smaller-the-better characteristic). At the same time it was demonstrated that the consumption of biodiesel is stimulated by the supply of rapeseed.

**Keywords:** biofuels, EU Member States, sustainable development, rapeseed.

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## Social and Economic Cooperation – Case Study Based on Association of Agricultural Producers in Poland

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### Abstract

The aim of the paper was to characterize the aspects of the farmer's social capital, as well as the benefits and barriers of cooperation between agricultural producers formed or functioning within certain producer groups.

Considerations are theoretical. In the article the monographic method was used. The following issues were subsequently examined: social determinants of farmers' cooperation, economic and social benefits and costs associated with cooperation between agricultural producers. As the example, the model of agricultural producer groups functioning in Poland was described.

The interaction of farmers in formal producer groups positively influences the organization and activity of the market of agricultural products. The most important benefit in this area are planning and adjusting production or demand for crops in terms of quantity, assortment and quality. Integration is linked to the increased competitiveness of farmers in national and global markets.

Despite of many economic benefits that can result from joint action, there are also social barriers such as: the level of knowledge and education of farmers, traditional attitudes towards all kinds of change, distrust of other members of the organization, and finally aversion to organizational innovation. It is also worth remembering about the negative historical experience of the general socialization that occurred in the countries of the former post-communist bloc during the years 1948-1990, as well as the reluctance to act (often socially) the function of leadership or the inability to do it.

**Keywords:** social cooperation, economic cooperation, agricultural producers in Poland

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## Ecologization of Production Process Versus Challenging Strategic Position of Meat Processing Enterprises in Poland

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### Abstract

This article aims to identify, measure and assess the ecologization of production process of meat enterprises acting in Poland in the period 2010-2017. In the study CAWI method, descriptive and comparative methods as well as financial analysis, in particular with individually selected set of financial profitability indicators tailored to the inland meat processing enterprises, were used. To operate on a complete, full and uninterrupted set of financial data, the financial data came from: Polish Monitor B (2010-2013) and the National Court Register (2014-2017). The study has been carried out now but some of the results already show that the ecologization of meat production process is expensive, is "a must", and influences the used position strategies of meat enterprises. In addition, a higher level and scale of production of meat enterprises can be used to justify higher exposure to the risk of their business. Results of the analysis indicate the advisability of further work in this area.

**Keywords:** sustainable, intelligent growth, agriculture, production process, strategic position, meat and poultry enterprises, Poland, Europe

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## **Application of Synthetic Taxonomic Measure Tmai for the Assessment of Investment Attractiveness of the Selected Food Industry Companies Listed on the Warsaw Stock Exchange in the Years 2013 - 2016**

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### **Abstract**

The food sector is one of the most important and fastest growing branches of the Polish economy. It employs almost 15% of all employees employed in the industry. Polish manufacturers are characterised by high competitiveness both in the EU and in the world. The macroeconomic environment in recent years has been relatively stable for the development of the food industry production in Poland, but the dynamics of agricultural-food products has experienced a slight slowdown. There were also fluctuations in profitability ratios in the sector, which may have been somewhat alarming for the investors. The article attempted to evaluate the investment attractiveness of 24 joint stock companies in the food sector, representing various industries, listed on the Warsaw Stock Exchange. The Taxonomic Measure of the Attractiveness of Investments (TMAI) and the company rankings were created for the years 2013 – 2016. The results showed that the Astarta and Wawel companies were at the top of the rankings in the studied years, representing the confectionery sector, and the Żywiec company from the beer industry. The meat and fish processing companies were more or less centred on the scale. The companies Agroton, Pepees, Pamapol and KSG Argo involved in the agricultural-food production and processing received the poorest evaluations of the investment attractiveness.

The synthetic taxonomic TMAI measure makes it possible to build company rankings within the analyzed group, from the point of view of the assessment of the financial condition and investment attractiveness of the surveyed companies. It can provide additional help in assessing the company's situation, e.g., for the investors.

**Keywords:** food industry companies, taxonomic measure, TMAI, investment attractiveness

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## **Modifications of the Currently Implemented European Union Common Policy Concerning Direct Payments**

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### **Abstract**

The paper presents the EU trend towards simplifying of the European legislation in the Common Agricultural Policy. Author remarks the Multi-annual Financial Framework should be focused on the simplification of the CAP and points out that the law should be created in simple, transparent and understandable manner for farmers. EU Members States must respect the principles of subsidiarity, proportionality and coherence. Paying attention to direct payments, there is underlined the importance of land greening in relation to the diversification of crops and the preservation of permanent agricultural land. Author concludes that only professional farmers who have acquired payment entitlements. The review of CAP has not changed the level of funding of agricultural policy in present financial perspective.

**Keywords:** direct payments, review of CAP, rural areas, simplification

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## Europe 2020 Targets: the Progress of the Baltic Countries in Terms of RIS3

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### Abstract

The Europe 2020 strategy was proposed by European Commission with an aim to improve European Union (EU) competitiveness and promote economic growth. For successful achievement of economic growth using Smart Specialization Strategy (RIS3) in EU European Commission set out five interrelated headline targets to achieve by 2020 in areas of employment, research and development, climate change and energy, education and poverty and social exclusion. Targets are translated into national targets for each EU member state at the same time they are common goals for all EU member states so mixing national and EU action. Authors of the research used statistical data about Europe 2020 targets to detect progress or regress of execution of these targets, accuracy of target value detection and implementation of RIS3 in EU.

The aim of the research is to evaluate RIS3 progress based on Europe 2020 targets. Following tasks were set: 1) Using Eurostat statistical data to calculate each Europe 2020 target progress for Estonia, Latvia and Lithuania; 2) To evaluate calculated data and compare with other Baltic countries and common EU; 3) To forecast RIS3 development for year 2020 in Baltic states.

The research employed the monographic and descriptive methods as well as analysis, synthesis, the graphic method, data grouping method and forecasting. All three Baltic countries have exceeded their target values on employment and education. Low indicators – just half of the target value – Baltic countries have on share of the EU's GDP invested in Research and Development. Other positions such as green energy, poverty and social exclusion mostly show a need for more active and effective action for achieving the Europe 2020 targets.

**Keywords:** Europe 2020 targets, smart specialization strategy

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## Building Social Capital through Leader Approach 2007-2013: Case of Latvia and Poland

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### Abstract

Building and developing social capital is regarded as a major factor underpinning the development of rural areas, while the LEADER approach to rural development has been found to have a great potential for creation and use of social capital. Therefore, the aim of the study is to explore the LEADER approach in building social capital in rural areas of Latvia and Poland, based on the thematic analysis of the implemented projects during 2007-2013. To achieve the objective, the study explores the introduction of the approach in Latvia and Poland, as well as presents project case studies for social capital formation in Latvia and Poland, by using appropriate materials and research methods. Projects carried out under the LEADER 2007-2013 in Latvia and Poland affect rural communities regarding social capital on different levels at the same time: build trust, create bonds around common values and raise citizens' involvement in joint initiatives. There are examples of projects that contribute to the building of structural social capital, relational social capital and cognitive social capital in Latvia and Poland. Overall, the thematic analysis of the realized projects in Latvia and Poland reveals that in relation to the social capital they have improved the possibilities for gathering and socialization, for participation in interest groups and associations. Never before in rural areas of Latvia and Poland there has been such a form of cooperation of different local actors, applying the bottom-up approach. Studies show that this approach works well in practice and brings intended effects to rural development.

**Keywords:** RDP 2007-2013, LEADER approach, rural areas, social capital

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## The Social Aspects of Rural Development Policy

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### Abstract

The rural development policy of Agricultural Property Stock of the State Treasury in Poland is conducted by The Agricultural Property Agency - APA (since 1.09.2017 - The National Center for Agriculture Support). The property managed by the APA includes agricultural land, forests, farm buildings, residential buildings as well as equipment and devices that are part of social, technical, production, commercial and service infrastructure. This article focuses on the social aspects of the APA's operations based on an analysis of the data supplied by the Regional Branch of the Agricultural Property Agency in Olsztyn. The results of the analyses were presented in table format. The rural development policy in point of view the realization of public purposes in rural areas was analyzed. The obtained information and materials were analyzed to identify social investments realized on agricultural land donated to local authorities from Agricultural Property Stock of the State Treasury. The results were used to analyze and to describe the social aspects of APA's operations in rural area in Poland. Rural areas require various types of social assistance services. The Agricultural Property Agency has successfully fostered social development in rural areas, and it has the required resources and experience to continue that mission.

**Keywords:** Agricultural Property Agency, agricultural land, social aspects of managing rural areas, rural development policy

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## **Selected Determinants of Multifunctional and Diversified Development of Rural Areas with Increased Natural Hazards in Poland**

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### **Abstract**

The strategy of multifunctional and diversified development of rural areas is based on three integral pillars related to social, economic and environmental policy. Directions and the rate of changes in the development of rural areas are determined, among others, by the range of local community needs, including those related to public security and economic capital. Modern times abound in various types of hazards, those of a technological, military or terrorist nature, but also those resulting from extreme natural phenomena, which include intense precipitation, lightning, snow melting or strong winds, contributing to e.g. floods, landslides or fires.

The study identifies present-day factors determining multifunctional and sustainable development of rural areas at risk of natural hazards.

**Keywords:** rural area, natural hazards, determinants

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## **Czech Agrarian Foreign Trade Comparative Advantages Distribution: Transformation Process**

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### **Abstract**

This paper primarily focuses on Czech agrarian foreign trade comparative advantage issues. The structure and comparative advantages distribution are analyzed in the period before (2001) and after the Czech EU accession

(2015/2016). The main central aim of this paper is to identify and analyze changes in comparative advantages distribution and trade commodity structure which have occurred.

Trade structure and comparative advantages distribution are analysed in relation to the EU and rest of the World (Developing countries, OECD members, CIS, etc.). Commodity structure (we applied HS system) is analysed specifically in relation to unit value development, trade volume development and comparative advantages distribution development. To successfully accomplish the above mentioned objectives, this paper applies Lafay index and Trade balance index. The results derived from individual analyses are highlighted through the “Product mapping method”. The product mapping matrix divides the entire set of exported products into 4 groups. The LFI index has been chosen for the “product mapping” approach because of its ability to take into consideration only those transactions which are truly related to individual countries’ trade performance. The TBI index has been utilized for its ability to divide the products according to their real trade performance into the above specified four quadrants.

In the analysed period, Czech agrarian trade increased its dependency on EU Countries. The share of EU countries in regards to Czech agrarian trade turnover has increased from 78% to nearly 90%. Czech agrarian exports are dominated by low processed and semi-processed aggregations having a low unit value. On the other hand, imports can be characterized by a much higher unit value and a much higher processing level. Unfortunately, the unit value of Czech agrarian exports has been constantly decreasing on the other hand the unit value of imports is increasing. Czech agrarian trade comparative advantages exist in relation to the following set of agri-food products: HS10, HS12, HS01, HS04, HS15, HS24, HS22, HS11, HS17, HS03, HS16, HS09, HS13 and HS14.

**Keywords:** Czechia, agrarian trade, comparative advantages, distribution, changes, development, unit value, volume, value, added value

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## **Strategic Planning of Community Led-Local Development and Implementation of the LEADER Approach: The Example of Estonian Local Action Groups**

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### **Abstract**

The present paper focuses on the two questions concerning the strategic planning of rural development. First, how do the strategies of local action groups (LAGs) reflect the seven main features of the LEADER approach? Secondly, how dynamic and effective is the seven-year cycle of local development strategy (LDS) for ensuring social and local innovation?

The empirical study is methodologically based on the qualitative content analysis of two LDSs, on MAPP methods and on comparisons with other local development strategies (local municipal development plans). The results of the study show that the effective implementation of the seven-year strategy takes place in a five-year period, and the seven-year planning period is not fully sustainably covered with development activities. For a period of two years the activities of LAGs practically stop. Also, the development of a new LDS uses a lot of local resources (time, people, money) that in turn affects the development of social and local innovation. The contents of the LDSs do not reflect all the seven main features of the LEADER approach in the equal extent. The both LDSs studied weakly addressed the formulation of common vision by several sectors, and the involvement of entrepreneurs to the community led local development.

As the financing from the previous LDS stops before the end of planning period and there is a need to continue with the previous projects, the integration of innovative elements to the new strategies creates problems, because there is a time gap between the programming periods and there is a lack of clarity on the content of next LDS.

In order to ensure socioeconomic sustainability of rural areas, the strategic planning for CLLD should start considerably earlier, either in the middle of the previous planning period or the duration of the LDS should be longer.

**Keywords:** Strategic planning, principles of LEADER approach, qualitative content analysis, MAPP method, Community-Led Local Development

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## Bioeconomy – Opportunities and Threats in Malopolska (Poland)

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### Abstract

The bioeconomy phenomena in Poland, especially in Malopolska Region, which comprises those sectors of the economy that use renewable biological resources from land and sea to produce food, materials and energy, face multiple challenges.

The main research area of the article is that the idea of the bio-based sector not only includes the more traditional activities (e.g. agriculture, food, forestry, fishing, etc.) but is further extended to encapsulate new areas of bio-based sector growth such as biomass supply, biochemicals and bioenergy activities, what could implies:

- the bio-based economy could bring the loss of relative competitiveness, especially in a short-time perspective;
- the bioeconomy's capacity to generate Polish growth and employment is diminished;
- choosing the biobased economy should be the “win-win” strategy for Polish agriculture in long-time perspective.

**Keywords:** bioeconomy, opportunities and threats of bioeconomy, sustainable development, Malopolska

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## **Regional Development Instruments for Promotion of Entrepreneurship in Territories With Unfavorable Socio-economic Situation: The Case of the Latvia**

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### **Abstract**

The development gap between regions and even countries has always been actual problem in field of regional policy. Regional development disparities especially are important problem in territories with unfavourable socio-economic situation. To minimize this problem, many Eastern Europe countries, including Latvia, implemented special economic zones and free ports **as regional development instrument** with aim to mitigate regional development differences between regions by attracting investments and creating new jobs.

Experience with special economic zones in Latvia are likely close with Poland's case, thus experts from Poland affirms that, every 100 jobs given in special economic zone create on average about 72 jobs outside the special economic zone hosting territory and 137 jobs in neighboring counties. Latvia, since the restoration of sovereignty, established five economic zones in total - two of them are situated in Latgale, which is the least developed region of Latvia. Researchers have not been widely contributed to **analysis of special economic zones impact to regional development**. Authors evaluated impact of investments and created job places of special economic zones in Latgale

region. Evaluation was done by estimating influence to unemployment level in Latgale region and amount of investments.

Results of research show that special economic zones as regional development instrument creates significant impact to regional development in territories with unfavourable socio-economic situation.

**Keywords:** economic policy tools, entrepreneurship, special economic zones, regional economic development

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## The Ways of Utilization 2007-15 EU Funding for Cultural Assets in Rural Areas of Northern Poland

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### Abstract

The EU financial resources are an important source of restoration and preservation of cultural heritage objects and their adaptation to the fulfilment of tasks resulting in the rise of new socio-economic functions. The purpose of the paper is to identify the ways of the spending of EU aid funds thematically related to cultural assets in rural areas in the macroregion of Northern Poland (Provinces: Pomorskie, Zachodniopomorskie, Kujawsko-Pomorskie). The article outlines the scale and structure of the use of European Funds for projects relating to the protection and promotion of cultural heritage. The analysis was conducted across the six types of projects distinguished according to their subject matter, that is to say the promotion of natural values, protection and valorization of natural heritage, other forms of support for the enhancement of tourism services, protection and preservation of cultural heritage, development of cultural infrastructure, other forms of support for the improvement of cultural services, as well as integrated projects for the revitalization of urban and rural areas. The information used in this study was based on the data pertaining to the projects co-financed from the European Funds and stored in the National

Information System (KSI SIMIK 07-13) as of 31<sup>st</sup> December 2016. On the basis of the analysis of the database the following categories of purposes were distinguished: revalorization of the cultural heritage objects, development of a new tourism product, sports and recreation infrastructure, promotion and others. Each of the above-mentioned spatial categories was analyzed in terms of its share and value: the total value and the level of EU co-funding provided for the accomplished projects according to the project purposes adopted in this analysis. Rural areas, which includes rural communes and small towns, were presented against a background of other types of regions: counties, towns with county rights, voivodship towns and the area of the voivodship. The temporal range of the study included the years from 2007 to 2015.

**Keywords:** cultural assets, EU funding, Northern Poland, rural areas

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## **Payments for Public Goods Under the Common Agricultural Policy Versus Market Failures**

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### **Abstract**

In the reality of the market, a situation often arises where an economic surplus achieved by agricultural producers is partly taken over by related non-agricultural sectors. In this sense the category of economic rent embraces market failures related to such factors as price flexibility, and thus represents an effect of the misallocation of resources in the agricultural sector. The question therefore arises of whether there exists a developmental model of agriculture in which such market failures would be reduced. The article addresses the question of whether CAP payments for public goods are a desirable systemic solution serving to reduce market failures. It is hypothesised that the financing of activity relating to the supply of public goods lessens the negative impact of the “market treadmill”, since it reduces the unexpected outflows of economic surplus away



from farms, caused by agricultural prices. To verify the hypothesis, a panel regression analysis was performed on three sets: the EU-15 countries, the EU-12 countries, and – within Poland – subsectors of farms from six standard output classes. The analysis covered the years 2004–2012. The results of the computations provided confirmation of the hypothesis. It may be stated that an increase in the level of payments for public goods, as a percentage of total subsidies to agriculture, leads on average to a reduction in the drainage of economic rents through prices. It was also found that the financing of public goods under the CAP is more effective in reducing market failures in the EU-15 countries than in the EU-12.

**Keywords:** public goods, Common Agricultural Policy, market failure

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## Analysis of Factors of Implementation of Social Innovations: The Case of Lithuania

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### Abstract

Government officials, policymakers and academicians express their concern about creating and developing social innovations according to the programme for Employment and Social Innovation (EaSI). According to European Commission, social innovation is used as social business model (SBM) Despite the increasing attention in global context to create SBM, the expansion of this complex phenomenon is minor. The main benefit of SBM is collaboration between non-profit, non-governmental organizations, consumer organizations

and other social actors from rural or urban areas to maximize social value. The object – factors which have influence on development of SBM. The goal of research is to carry out orthogonal factor analysis using statistical package IBM SPSS version 20 and MS Excel 2012. The results are based on the data, which collected by conducting unique questionnaire survey in 2016. The study provides a comprehensive analysis of external, internal, social and governmental factors, hindering cooperation among institutions and affecting creation of SBM. The factor analysis and hypothesis-tested for the independence of qualitative characteristics, revealed several key factors, that influence SBM in Lithuania, and the dependencies between them. The findings showed if the external factors of SBM: rapid technological progress, easier access to the distribution channels, lower market distortion and more information in mass media. These aspects trigger to reach higher level of application of SBM, as well as associated greater managerial incentives. The controversial aspect appeared that a concept of SBM in scientific literature differs from the concept which is stated by the Ministry of Economy of the Republic in Lithuania in legal regulation documents. Factor analysis may encourage social entrepreneurs create new markets for rural and base-of-the-pyramid (BoP) populations. For future investigations could be explored and analyzed support elements for influencing factors and initiated regression analysis, showing the impact, which is important creating new policies and strategies for sustainable rural development of SBM to involve main actors and gather its networks to generate social and economic outcomes.

**Keywords:** factor analysis, rural development, social innovation, social business models

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## **An Individual Level of Social Innovations for Rural Development: Aggression among rural adolescents**

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### **Abstract**

Social innovation is very important for rural development. It is a lack of researchers about an individual level of social innovations in Lithuania. Adolescents' aggression is an important social problem that can affect society and social innovations. It needs to find the differences in aggression between rural and urban adolescents because it could help to plan effective interventions for reducing aggressive behavior. The present study aimed to assess the aggression among rural and urban adolescents. It was hypothesized that rural and urban adolescents differ significantly on aggression. In order to verify the above hypothesis a sample of 479 (207 boys; 272 girls) students were selected from Lithuanian schools. The sample includes the similar size of rural (N=242) and urban (N=237) students. The age of participants was from 12 to 17. It was used Aggression Questionnaire developed by Buss and Perry (1992) in this research. The questionnaire involves four subscales: physical aggression, verbal aggression, anger, and hostility. The results showed that urban girls had more physical aggression than rural girls. However, it was not found statistically significant differences in physical aggression among urban and rural boys. Also, it was not found any statistically significant differences in verbal aggression, anger, hostility among urban and rural adolescents.

**Keywords:** Adolescents, aggression, rural region, urban region

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## Smart Educational Technology in the Learning Process at a Rural Vocational Training Institution - A Case Study

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### Abstract

Smart educational technology in the learning process at a vocational training institution directly correlates to the pedagogical and methodological preparation of teachers and their practical experience. The pedagogical preparation determines better learning outcomes, effective social and cultural expressions, and more qualitative guidance of the didactic process. In addition, teachers with the help of technology could draw attention to each student, help the learner to know himself and his or her field of professional expression. This case study examined the ability of vocational teachers to use various technologies in class. Study was conducted in five rural vocational training schools in Lithuania. Twenty-five vocational teachers were interviewed using focus group interview format about their smart educational technology usage in teaching and contacting their students. Teachers were observed manipulating, transforming and allocating appropriate digital media, adapting teaching content and easily forming teaching-learning networks to achieve educational goals. Overall, the process described here showed that regardless of how long vocational teachers work at a rural school and what subjects they teach, mostly teachers communicated and collaborated through technologies with their students while presenting vocational teaching content. Finally, the technological competence of vocational teachers reflected the teacher's ability to carry out a certain vocational teaching process: the ability to perform technological operations, the skill to work with various materials, equipment and the mentoring capacity.

**Keywords:** case study, learning process, smart education technology, teachers' perspective, rural vocational training institution

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## **Structural Changes of Farmer's Farms: Case Study of Lithuania**

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### **Abstract**

Due to historical circumstances, the development of Lithuanian commercial farmer's farms is slow; however, farmer's farms are very important to the vitality of rural areas while developing agricultural commodities and goods. The purpose of this article – to analyze the structural changes in farmer's farms and present the directions of future development. Structural changes in Lithuanian farmer's farms during the 2005 – 2015 timeframe were analyzed while looking at the diagnostic indicators, which are the following: the number of farmer's farms, the structure of farmer's farms according to their size, the activity units of farmer's farms, age of farmers, farmer's farms sources of income. In order to study the statistical data, methods of systemization, logical analysis and generalization were applied. The analysis of the statistical data suggests that the following structural changes are taking place in Lithuanian farmer's farms: the number of registered farmer's farms increases and the farmers' are getting younger. One of the most significant factors causing the structural changes in holdings – the EU financial support for the agricultural development and the changing customer demands. More and more often rural areas perform residential function and new living areas are developed.

There is a predominance of the small farms (up to 10 hectares). This is mainly a result of the reform in agricultural sector at the end of 20th century. Many small agricultural holdings were established due to this reform. However, significant changes occur while choosing and/or combining the activity units of the farm: the number of farms specializing in crops increases, the number of the holdings focusing on livestock and combined farming (crops and livestock) is declining; also, farmer's farms with diversified income or the activity units grow in number. Limited opportunities to intensify agricultural production in small farmer's farms caused the fact that activities or income were diversified.

The model of family farm remains; however, the relation between activity and the usage of family's labour in farm activity changes.

**Keywords:** factors that determine the changes, farmer's farms, structural changes.

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## **Social Capital Development of Rural Community Members in a Virtual Community**

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### **Abstract**

The scholar literature on simultaneous using of social capital explore knowledge and identity resources as well as actions and interactions benefiting the community through personal bonds of individuals; issues of common trust; and adapting the current understanding in new situations. In this article, we instead examine rural community influence on social capital building of adult person in a virtual community. A quantitative survey was done in 246 local rural communities in Lithuania which reflected their community activities on a virtual basis. From the data of 500 informants we found that rural community (human social network) members were also active in the virtual communities. Research participants from rural communities expressed their will to be the part of a virtual community and virtually solve various local community issues. Active members of virtual communities actively participated in live community activities. Local community members peer-learned while sharing knowledge and experience in virtual communities. We argue that belonging to a virtual community inspire rural community members to train their virtual and live communication skills and peer-learn. Virtual community could contribute to self-regulated learning by stimulating sense of sociality and identity of rural community members. Virtual community could operate as self-regulated learning space for rural community members. Social capital development would

be more intensive when the members of rural community actively engage in social communication, cooperation and exchange of information, and mentor each other. This survey highlights the virtual community influence the social capital building of rural community members in Lithuanian context.

**Keywords:** adult person, belonging, rural community, social capital development, virtual community

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## **Towards Sustainable Rural Development: Landscape Approach for Integrative Knowledge Production and Learning**

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### **Abstract**

The current depopulation of Lithuania leads to declining population density and therefore to deteriorating social networks, especially in rural areas. This has negative consequences for the quality of life and social capital. It is thus crucial to empower rural stakeholders to cope with the future development of sparsely populated areas. One solution is to develop new types of jobs linked to natural, biocultural and cultural heritage. The aim of the European Union's policy about green infrastructure is to maintain functional networks of natural and semi-natural areas that sustain biodiversity and deliver ecosystem services for human well-being. This calls for application of landscape approach based on development of place-based partnerships aiming at knowledge production and learning about protection, management and restoration of different types of green infrastructure. Model Forest, Biosphere Reserve and Long-Term Socio-Ecological Research platform are three examples of landscape approach concepts. Based on a review of initiatives to implement these three concepts in

western and eastern Europe we conclude that a successful strategy to practice the landscape approach would be to enhance the spatial planning capacity of Lithuania and countries in a similar position. This requires (1) reducing disciplinary formal and informal control of integrative knowledge production and learning by securing successive projects with a long-term strategy, (2) engaging stakeholders at multiple levels of governance, (3) engage and integrate social and natural science research and stakeholders into place-based problem-solving activities, and (4) team building based on self-reflection and experienced leadership. Sharing of quality-assured practices among landscape approach concepts and initiatives to implement them can improve multi-level learning by evaluation, and ultimately effective governance, planning and management towards implementation of EU policy on functional green infrastructures on-the-ground. More intact natural, biocultural and cultural heritage in eastern compared to western Europe are important assets towards sustainable rural development in Lithuania.

**Keywords:** transdisciplinary research; social-ecological system; stakeholder engagement; collaborative learning

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## Singularity of Sustainable Taxation in Agriculture

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### Abstract

Agricultural sector is different from industry or service sectors due to its specific functions, i.e. food function, social function, economic situation on country growth function, environmental function. These functions of



agricultural sector include three dimension (economic, social, environmental), which are closely connected with the conception of sustainable development. Therefore, the taxation system of agricultural sector has been orientated to sustainability.

The paper aims at disclosing the singularity of sustainable taxation in agriculture. To investigate the theoretical aspect of the specificity of agricultural business in the context of taxation and singularity of sustainable taxation, systemic analysis and synthesis of theoretical insights of foreign and local scientific literature as well as the methods of induction and deduction have been applied. Theoretical research results helped to identify singularity of sustainable taxation in agriculture, which encompasses three dimensions (economic, social, environmental) with different characteristics. This taxation system contributes to the goals of the development of sustainable agriculture.

**Keywords:** agriculture, sustainable agriculture, sustainable taxation, taxation.

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## **Current Challenges of Agricultural Business Against Farming Economic Efficiency and Sustainable Development**

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### **Abstract**

In the paper there were presented circumstances determined modern agriculture and agribusiness challenges, especially in Poland, and an overview of methods ensuring sustainability and value-added agriculture.

Study of literature and the authors' publications were used to present circumstances and methods for combining sustainable agriculture and rural development with economic efficiency, taking into account climate change, healthy food, organizational and technological progresses.

The challenge facing modern agriculture is the ability to efficiently implement farm innovations, acquire new knowledge and effectively use progress in farming. Negative effects of intensive farming for environment cause to seek

for solutions let face economic and environmental challenges for contemporary agriculture and for rural areas development, too. The ability to use innovation in agriculture will determine its development chances and competitive position in the international arena.

Serious threatens resulted in a climate change can cause imbalance in food supply and demand. Climate change and its associated higher frequency and severity of adverse weather events require inter alia genotypic adaptation. Food supply and food security in Europe as well as in many other parts of the world especially depend on the Triticale crops, which include wheat, barley, rye, and fodder crops. Hence, some studies on genetic progress in those crops adaptation were presented.

Also a yield gap analysis let us to solve important problem of economic and environmental goals amalgamation. Hence, some approaches how to assess and collect data for yield gap analysis, and to summarize the yield gap explaining factors were identified. The presented results showed also that although management and edaphic factors are more often considered to explain the yield gap, both farm characteristics and socio-economic factors often explain the yield gap.

Sustainable development of Polish agriculture should consist in achieving economic competitiveness with simultaneous ability to ensure sustainability in the social sphere. It can be reached through the increased use of innovative technologies that are designed to increase agricultural productivity and at the same time to increase the sustainability of organic farming. Implementing the principles of sustainability assures companies compliance with environmental policy guidelines and also makes the company perceived by consumers as environmentally friendly.

**Keywords:** agriculture, farms, food security, economic efficiency, competitiveness, sustainable development

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## **Socio-economic Benefits of the Development of Liquid Biofuels Market in the European Union**

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### **Abstract**

The production and use of the liquid biofuels currently play an significant role in the European Union's energy policy, as demonstrated by the existence of the 2020 climate & energy package, to some extent dedicated to the liquid biofuels (10% share of biofuels in fuel consumption). At the same time, the biofuels sector is an important part of the bioeconomy both within the European Union as a whole and in some of its Member States. Biofuels sector may be a relevant determinant of the development of the agricultural sector, the bioeconomy and the whole economy primarily through the job creation. The development of the biofuel sector has been dynamic for more than 10 years, but from the very beginning of this process has been accompanied by a number of controversies, because the production and use of liquid biofuels have both positive and negative effects. These consequences concern primarily the economic, social and environmental areas. The aim of the article was to identify and attempt to quantify the benefits resulting from the development of the liquid biofuels sector in the European Union and its selected countries. For this paper a labour efficiency ratio for the liquid biofuels sector was developed (it can be identified with the work effectiveness). The period under research covered years 2009-2015. Descriptive statistics methods and correlation analysis were used in the paper. The data are mainly from Eurostat. Research carried out in this article provides general conclusion that the high level of economic development (measured by GDP per capita) is not accompanied by the high work effectiveness of the liquid biofuels sector. In recent years, work effectiveness leaders have included mainly the new EU countries – Slovakia, Hungary, Romania, the Czech Republic, Lithuania (accession in 2004 or 2007), and to a lesser extent rich economies, i. e. Austria, Sweden. At the same time, the Benelux countries, Spain and subsequently the leading countries in the production and consumption of biofuels in the European Union – France, Germany and Poland have achieved the lowest labour productivity levels. This proves that the scale of biofuel production and use is not a determinant of efficiency.

**Keywords:** liquid biofuels, turnover, job creation, work effectiveness of the liquid biofuels sector.

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## The Use of Coaching in the Agricultural Value Chain

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### Abstract

Agricultural organizations are faced with continuous processes of change: economic openness, national and international competition between companies, adaptation to new business management models -Corporate Social Responsibility-, changing markets and the need to comply with regulations and certifications. This has led to the generation of a great demand for knowledge, preparation and motivation of the people who work in the organizations and in the agribusiness environment. Organizations are obliged to seek strategies or business techniques that allow them to guarantee survival and increase their levels of competitiveness. Among these techniques the coaching technique is highly positioned. The objective of the research was to analyze the use of coaching in the agricultural value chain as a tool to contribute to rural development. The study analyzed 50 coaching companies in Spain, from which qualitative and quantitative data of agricultural and rural coaching were taken. Moreover, a sample of 22 coached agribusinesses in Spain was characterized in order to obtain a profile of the coaching in the agricultural value chain. Frequency, contingency and significance analysis were used to characterize the performance of coaching in the agricultural value chain. Coaching tools are mainly used by large, food and beverages companies being necessary to implement the coaching activities among small agricultural organizations in order to improve the competitiveness in the complete value chain. It is probable that the coaching companies located in Castilla and Leon, Navarra or Cataluña, recently founded as limited liability companies and with two to ten employees, coached the larger number of agricultural businesses. The results show that a business attitude among coaching is needed while the use of a combination of

coaching tools could improve the agricultural value chain and rural development. It is necessary to promote the coaching techniques among the agricultural value chain, especially at the first stages of the chain, in order to increase the agricultural businesses competitiveness and to contribute to the rural development.

**Keywords:** Agribusiness, Competitiveness, Leadership, Motivation, Rural Developme

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## The Individual Sector of Agriculture in Moldova and its Contribution to the Development of Rural Areas

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### Abstract

Moldovan agriculture is still characterized by a pronounced structural dualism with a very large number of small-scale family farms. The accentuated poverty makes rural economy to flow more and more to a natural subsistence economy, isolating itself from the market economy. The scope of the paper is to assess the farm performance and its contribution to the development of rural areas. The research analysis is based on national statistics and survey data of 723 farms. In order to assess farm performance technical efficiency (TE) and stochastic frontier analysis is used. The contribution of different types of income on the farm development level is analysed through regression analysis. Increasing of farm performance through a higher efficiency and competitiveness could be regarded as the key solution to the low income problem of rural families.

**Keywords:** agriculture, family farms, rural development.



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## **Employment in vs. Education for the Bioeconomy**

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### **Abstract**

A number of employees is one of the basic indicators applied for identification of the economic relevance of an industry or an economic sector. Referring to nearly 18.6 million people employed in the 28 EU Member States within the bioeconomy in 2014, it can be stated that this is an economic sphere of significant importance in the European economy. It includes activities within: (a) agriculture, (b) food, beverage and tobacco industry, (c) wood products and furniture, (d) bio-based textiles, (e) manufacture of paper and paper products, (f) forestry, (g) bio-based chemicals, pharmaceuticals and plastics, (h) fisheries, (i) biofuels and (j) bio-based electricity. This overview proves that bioeconomy requires specialists of different disciplines for whom work with renewable biological resources is a common feature.

The main aim of the study is to investigate tertiary education in bioeconomy based on the Polish experience in the Bioeconomy subject area group started within the framework of the Euroleague for Life Sciences (ELLS). Since 2015, attempts were taken by both academics as well as students to find a common approach to bioeconomy teaching. To realize this aim there was used data: (1) from CAWI research among students of WULS-SGGW on their attitudes to the bioeconomy realized in 2016, (2) feedback of participants of the first summer school in bioeconomy coordinated by WULS-SGGW and organized in Warsaw in 2017. Preliminary results of the research process display that the majority of Polish students did not meet the term of bioeconomy generally as well as at the university. There is also one very important students' comment which can describe their attitude: students of economic disciplines are not very much interested as they think that bioeconomy focuses on life sciences (bio) so it is not appropriate for them; students of different fields of life sciences are not very

keen to study bioeconomy as according to them it focuses on economy (as in the name itself).

**Keywords:** bioeconomy, employment, tertiary education, student

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## Multidimensional Poverty Measurement in Regions of Slovak Republic

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**Abstract:** The paper is focused on poverty and its measurement applying multidimensional approaches, which are used to capture the complex problem of poverty. Poverty is a complex problem, which can be measured in different ways. Poverty can be viewed either from one point of view (monodimensional aspect) or in several views (multidimensional aspect). Poverty is composed of several partial problems, not only of financial problem as it is often thought. Therefore it is necessary to highlight the multidimensional view of poverty. The main objective of paper is to determine the ranking of most endangered regions by risk of poverty with application of a multi-criterion evaluation of the CIPL Indicator (Cumulative Indicator of Poverty Level). Researched criteria are in our case: Gini Coefficient, income inequalities, poverty risk rate, registered unemployment rate, low labour intensity, life expectancy at birth, share of primary education. The aggregate indicator of poverty level analysed in years 2005, 2010 and 2015 showed that the southern and eastern part of Slovakia regions suffered the most poverty.

**Keywords:** poverty, poverty measurement, multidimensional poverty

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## Socio-economic Role of Value Added Agriculture in Uzbekistan

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### Abstract

The goal of this paper is to analyse socio-economic role of value added agriculture in Uzbekistan. The main agricultural exports are cotton (raw and yarn), fruits, vegetables, leather, wool and fur. There is an opportunity to acquire more social and economic advantages by exporting finished goods, which are made out of primary agricultural commodities. Adding value to agricultural products lead to increasing the share of finished goods in export, supplying import-substituting products, improving infrastructure in rural areas, providing new jobs and growing people's income. The paper presents the analyse of the agriculture sector in GDP and the production dynamics of the primary agricultural commodities during 2005-2014, as well as comparison the share of cotton, fruits, vegetables and leather in export in 2005 and 2014. Based on the analyses it is recommended to widely use value added agriculture in order to support people, who are living in rural areas in Uzbekistan.

**Keywords:** export, share, value added agriculture, socio-economic role, primary agricultural commodities

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## **Causes of Spatial Transformations in Rural Areas in Poland**

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### **Abstract**

Rural areas, defined as land outside towns, except industrial areas, account for over 93% of the area of Poland. They are attractive as a places of work, residence, leisure, as well as places where agricultural and non-agricultural business activities can be conducted. Agriculture is naturally associated with rural areas. Currently, apart from the agricultural function and (depending on the socioeconomic, natural or historical conditions) rural areas are also places of leisure, recreation, residence or industrial activities. This is a consequence of implementation of the concept of multi-functional development of rural areas, in which conditions are created for diverse business activities, while respecting environmental constraints. Such a multifunctional approach must take into account the interests of all parties to avoid spatial conflicts. Therefore, actions aimed at the development of rural areas should be based on an in-depth analysis of the value of the area under consideration, they should take into account natural conditions of the land for conducting agricultural activities, but also take into account environmental, social and economic aspects.

Objective and historical conditions affecting agriculture in Poland and the experience gained so far indicate that there is a need to change the spatial arrangement of agricultural areas. This is because of the characteristic features of agriculture in Poland, which include a disadvantageous structure of farms in terms of their area, small size of farms, insufficient technical infrastructure in villages and difficult soil conditions. Rural areas in Poland, including agriculture, are undergoing deep structural changes in regard to agricultural production, but also to farm size and layout, demographic and spatial structures as well as technical and social infrastructure. The changes taking place in rural areas in Poland are greatly affected by the Common Agricultural Policy in the European Union. As a member of the EU, Poland has been receiving aid since 2004 and has been implementing actions within Rural Development Programmes.

The aim of this paper is to analyse the transformations that have been taking place in rural areas in Poland and to present selected factors and causes of the changes in rural spaces.

**Keywords:** rural areas, rural development, spatial transformations

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## **Planning the Course of the Technical Infrastructure of Transmission Parameters. Spatial and Economic Effects**

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### **Abstract**

A technical infrastructure with transmission parameters is needed to supply regions with fuel and energy, and in the case of municipal territorial units, it is also needed to ensure the supply of water to residents and businesses and to allow for the discharge of liquid waste (sewage). Currently developed transmission networks also include fibre optic telecommunications lines. The existence in space of wires and technical infrastructure is preceded by the planning of its route. In Poland, planning the course of infrastructure is based on planning regulations or specific provisions called “specustawy”. Before establishing proper planning development, or issuing an appropriate administrative decision for the determination of the location of an investment, the network location is determined by the designer, selected by way of a tender by the investor. The future course of the network is dependent on the design assumptions. Due to the economic conditions of each investment, the planned route of the technical infrastructure should be as short as possible, and this causes accidental intersection of plots owned or being in perpetual usufruct of the different units. The manner of intersection of plots which have been previously used in a different way and the manner of use of plots of land located on the route of the planned investment generate a different degree of inconvenience to their users. This article describes the issues concerning the

effects of the planned use of real estate in terms of technical infrastructure and economic space.

**Keywords:** technical infrastructure, spatial planning, damage, compen

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## Mathematics as Potential for the Person's Resilience

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### Abstract

The role of mathematical education in the development of person's intelligence and personality and also application in everyday life, professional activities, attitude towards the role of mathematical knowledge in the labour market is widely discussed in the literature. In order to reflect the views of the respondents on the issues of mathematical learning and the potential values of mathematics, the survey was carried out. The questionnaire includes three diagnostics blocks: The role of mathematics in everyday life; in professional activities / in relation to the labour market and mathematics for the general development of a person. The respondents had to assess the given statements by expressing their approval or disapproval on a 4-stage Likert scale: strongly agree, agree, disagree, and strongly disagree. The research data analyzed by the respondents professional field, gender, age and mathematics learning experience. Research results show that mathematics is widely used in everyday life and in professional activities as well as give advantage in the labour market. It is difficult to learn mathematics but it has a high value. Therefore since the subject of mathematics increasingly becomes an instrument for promoting broad all-round education and personal development, many higher education courses have to be mathematics-intensive and students need a high level of competence in the subject to promote person's resilience.

**Keywords:** mathematics, mathematical competence, person's resilience



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## Public Food Procurement - The Situation in Latvia

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### Abstract

One of the most important medium-term tasks in Latvia is the promotion of production and consumption of local food through implementing measures aimed at increasing the market share of food products produced in Latvia in public procurement and consumption.

The research aim is to examine the situation of public food procurement in Latvia and assess the changes of local products share in public food procurement.

In Latvia, at the end of 2014, in response to Russia's embargo on the Latvian-produced food products and to promote local food consumption in the country was accepted new Regulations. These Regulations prescribe the requirements for public procurement using environmental criteria, and their application, as well as the applicable tender selection criteria for the food supply and catering contracts.

This contributed an increase of the quantity of purchases where ZPP criteria were used, thereby also increased the share of local production. The purchase of food from local farmers positively affects local entrepreneurship, while providing a significant income source for the local farmers; in this way, the viability of many small local agricultural holdings is maintained.

Research methods used: monographic, descriptive, analysis, synthesis, statistical analysis. The present research was performed based on the statistical data, research papers and other information sources.

**Keywords:** local food, public food procurement, sustainability

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## **How Can Solidarity in a Community Improve the Quality of Life?**

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### **Abstract**

Our thesis states, that the social capital can increase in through establishing a union of solidarity. By achieving this, we will not only create new places of employment, but also support, acceptance, new friends and social relationships but also gain additional knowledge and build networks. We show that the transaction cost will be reduced and the quality of life augmented by discussing different projects. By examining a moon-shot project in Germany in Trier called SOLAWI, we show the possibilities of encouraging citizens to work conjointly on agricultural land to produce fruits and vegetables for their own needs. The focus is on common work, on common effort and on common results. Another project in rural areas is the initiative of consolidating small and medium sized enterprises, by offering a break first each week on Wednesday morning (Fixed date and time) with the focus on networking. The third project is the three-month-interval meeting offered by equal opportunity commissioners in plural communes for female entrepreneurs. Here the women have the opportunity to adopt new knowledge and to compare notes with experts or other entrepreneurs about actual problems or new situations. In addition, we will discuss the latest project to establish new work places in the EIFEL by forming a special position for one person only to assess and inform people about recent possibilities. After that, we make an excursus to inclusive living on the countryside and we show that it is affordable and feasible. At last, we show the possibilities to augment the solidarity of rural areas by using information systems, as well as consider the limitations. In conclusion, we discuss the effects of staying together on the quality of life. Round about 120 students have worked on these projects and they have created workflows for the needed activities to meet the targets.

**Keywords:** Solidarity union, networking, permanent learning, political influence.

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## **Sustainable Consumption – Between Theory and Practice**

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### **Abstract**

The aim of the considerations is to define the essence of sustainable consumption as one of the conditions of the practical realisation of sustainable development concept. The paper underlines the importance of sustainable consumption implementation as well as its importance for the future development. The existence of narrow and broad understanding of sustainable consumption was indicated in the elaboration. In the first case, it concerns environmental aspects, whereas in the second, it covers three dimensions: economic, environmental and social ones. The authors also indicated the practices in fames of sustainable consumption on different levels, i.e. individuals, households and governmental ones. They considered different aspects of sustainable consumption, which is an alternative occurrence in relation to consumptionism and manifests itself in eco-consumption, collaborative consumption, deconsumption and responsible consumption. Nevertheless, sustainable consumption is on the margin of mainstream consumption processes. The elaboration also presents a number of factors and obstacles for realisation of the sustainable consumption, both on demand and supply side. First, it requires fundamental changes in value system, social awareness and consumer habits. The state should use particular tools (informational, legal, economic and financial ones) to enable realisation of the sustainable consumption concept.

**Keywords:** change, consumption pattern, development, sustainability



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## **Autoethnography as an Alternative Method of Combining Social Research with the Development of Rural Social Capital**

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### **Abstract**

Many regions in Poland can be said to be a unique example of preservation of cultural heritage. These include Silesia, Kartuzy, and Karkonosze Mountains. The nature of these regions is to preserve the traditional way of life and customs as well as the architecture, especially the sacral architecture. There is also much easier on mutual trust and building social capital, because you can always refer to the universal values of ancestors. However, there are also regions which, under the influence of migration and post-displacement processes after World War II, have lost their cultural and social character. Economic emigrants and displaced people from the Eastern Borderlands and Central Poland shared poverty and desire to settle. How do they succeed, and is there a chance to recreate and build a new identity? This is the question we are trying to answer, and the article is a presentation of some of the results. By moving on the border of autobiographical and ethnographic methods, authors adopt an autoethnographic method (narrative interviews, participant observation, biographical methods), which means turning to narratives as a way of research and as an expression of the search for a different relationship between the researcher and the subject and between the author and the reader. The researchers use their own experiences here as a source of description of the culture in which they participate and examine. As a result, it arises a text, a story created by the local community and researchers, aimed at reproducing and creating identity in the post-immigrant rural communities based on experienced and historical memory. The research was conducted in the years 2016-2017 in the Pomeranian and Lower Silesian voivodships in Poland.

**Keywords:** qualitative research, autoethnography, rural social capital, identity of post-migration communities

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## Satisfaction of Rural Population with Public Services in the Regions: Analysis of Educational Indicators

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### Abstract

The key idea of the well-being concept reveals the main guidelines for societal monitoring as it tries to answer the question about how well the needs of people in a society are met across various domains - the physical, economic, social, environmental, emotional, and spiritual – as well as individuals' evaluations of their own lives and the way that their society operates (Gilbert, Colley, Roberts, 2016). The efforts to measure community satisfaction have never lost their relevance as they are directed towards the development of systematic approach to societal monitoring. The presented research also aims to complement to this approach. Its theoretical concepts are: "rural-city differences"; "Objective and subjective quality of life", "Public services and their quality", "Measurement of satisfaction with public services"; "Education indicators". Research methodology is centered around a standardized questionnaire for population covering 193 primary indicators, which measure satisfaction with various public services: health, social security, culture, public transport, utilities, environment, recreation and sport, public communication, education, etc. The methodology projects the following quantitative aspects: the percentage of



service benchmarking and the percentage of ranked service (PR) in the rate of 193 positions. The advantage of the methodology is that it transforms the indicators, which are not comparable in terms of conceptual and official statistics, into relatively homogeneous indicators of opinion. The latter can already be compared and ranked. The methodology is very functional when it comes to identifying: (a) those public services that are subjectively perceived as poor, good or medium; b) it is necessary to look at the satisfaction of the services of a particular sector in different district areas, towns and villages. The survey data is used for societal monitoring: for budgeting, strategic planning, investment program development, quality assessment of the various services, indirectly - even for successful local government elections. The aim of the research is while using the above mentioned methodology on satisfaction of rural population with public services to highlight the analysis of educational indicators (among the 193 indicators, even 23 indicators are about education). The latest data were collected in 2016-2017 in 3 regional municipalities: municipalities of Kaunas district, Jonava and Radviliskis. Total sample of respondents in 3 municipalities is 4268 (n – 4268). In the case of educational indicators, the statistical regularities, which are typical for all the municipalities under investigation, were determined. The results of the analysis show that: 1) rural residents' satisfaction with formal general education services is relatively high. The only negative exception is the "the access to a child's place in a pre-school institution based on the place of residence"; 2) rural residents poorly evaluated educational services that are related to non-formal education, adult education, the education of children with disabilities, child safety, meaningful occupation of children and young people during all day, preventive programs. These major conclusions let to state that local self-governmental institutions are not capable to cope with the quality challenges of some educational services without central government and the EU's special intervention policy. A negative impact is also reinforced by rapidly deteriorating demographic situation in Lithuanian rural areas.

**Keywords:** rural development, societal monitoring, rural population satisfaction, educational services

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## **Modeling the Tax Policy of Agriculture Enterprises**

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### **Abstract**

Agriculture enterprises play an important role for Lithuania's agriculture and economy as create the gross value added and new jobs and carries substantial value in social, ethnocultural and environmental aspects. Tax modeling has received considerable attention recently both at the EU institutions and in the scientific research domain. L. Tulush (2015), N. Ivanova et al (2012), E. Klamut (2016), E. Dace et al, (2015), C. Vjetkovic et al, (2015), J. Pawłowska-Tyszko et al (2015), K. Mittenzwei (2017), D. Nerudova & K. Kkrchniva (2016) and other researchers have been dealing with tax management methods, assessing this process, analyzing implementation of the taxation theory in business enterprises, the effect of taxation on measures assumed by the authorities and social welfare.

Research problem is: what methods are applicable to the appropriate tax policy modeling for agriculture enterprises.

Research aim is to develop a theoretical tax model for agriculture enterprises and demonstrate its applicability.

Tax modeling techniques and methods, their advantages, shortcomings and applicability have been studied under the methods of analysis and synthesis of scientific literature and EU legal acts. Under the method of modelling employed in this study, the model of tax policy in a agriculture enterprises has been developed and covers the following stages:

economic operation and tax analysis of the company serving as the basis for identification of tax goals;

- formulation of the objectives applicable to the tax policy;

- exploration of the tax payment options (scenarios) most favourable to the agriculture enterprise and calculation of their benefit to the enterprise;
- formation of a long-term taxation strategy.

Tax policy model has been designed and verified empirically in the 25 agriculture companies in Lithuania.

**Keywords:** Tax, Tax Modeling, Agricultural Enterprises.

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## Local Conditions of Production and Economic Disagrarization of Farms

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### Abstract

Evolution of agrarian systems in countries with fragmented agricultural area structure leads to a decrease in the number of farms and an increase in the area and effectiveness of entities developing their activity. It is necessary to find out the causes of disgrarization - a process that is manifested at the macroeconomic level in reduced significance of agriculture in the national economy, among other things, and reduced importance of agricultural incomes in the economy of the countryside and a part of farms at the microeconomic level - in order to effectively impact ongoing changes that often affect the whole regions. The paper is an attempt to identify the factors determining the intensity of the process of the production and economic disgrarization of farms in Lesser Poland Voivodeship. Calculation procedures performed using the zero unitarization method and Data Mining tools enabled assessment of the intensity of the phenomenon analysed in the different territorial units (gminas), and

identification of factors that have the biggest impact on its intensity. Using the process of modelling by the C&RT method it has been found out that the characteristics that describe the agrarian structure historically, i.e. intensity of the organisation of agriculture, fragmentation of the agrarian structure, had a big impact on differentiation of gminas in terms of the intensity of disagrarization. High intensity of the organisation of agriculture combined with good environmental conditions is conducive to the retention of production functions of agriculture in a given area. With low intensity of the organisation of agriculture and very large fragmentation of the agrarian structure, the intensity of disagrarization was very often determined by characteristics typical of periurban areas or tourist attractions, i.e. increase in population density and increase in the number of residential buildings. Urban development of a given territorial unit stimulated processes of exiting agriculture.

**Keywords:** disagrarization, farm, urbanised areas, C&RT

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## Grounded Theory Methodology in the Context of Social Innovations for Rural Development Research

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### Abstract

Although the Grounded Theory (GT) methodology has been developed for over 50 years and is one of the most popular methodologies in the world, it is not often used in rural development research. In order to update the possibilities of applying GT in rural development research, this article presents the evolution

of the development of GT methodology and the possibilities of its application in rural development research. The classic GT strategy is discussed in more detail, as methodology which provides the possibility to researcher to look at the phenomenon from inside without formulating the hypothesis, i.e., to “emerge” the theory, which reveals the main concern and explains how it is resolved, by conceptualizing the authentic experiences of research participants. The article aims to explain that classic GT is a "full package" approach, discusses its coding process; reveals the principles of the emerging classic GT. The GT methodology is discussed as the paradigm that can help researchers discover new insights and develop new theories, explaining the processes of social innovations for rural development.

**Keywords:** grounded theory, social innovation, rural development

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## **Prospects for Sustainable Agriculture in Poland in the Opinion of Farmers**

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### **Abstract**

Contemporary image of European, including Polish, agriculture is constantly undergoing transformation. At present more and more attention is paid not only to the quantity but to the quality of production. Environmental aspects are also extremely important. Agriculture is a sector of the economy which draws on natural resources from which quality and abundance depends, but it also constantly changes and shapes these resources. Sustainable farming requires farmers to have theoretical knowledge and practical skills. It is extremely important, in this context, to educate future generations of farmers on a sustainable farming model that aims to combine economic, environmental and social goals. The aim of the presented research was to study declared agricultural practices consistent with the concept of sustainable agriculture by students of agriculture. They will shape the image of future agriculture in the

region. They will also act as innovators who will be imitated in their surroundings. The research was carried out in the years 2014-2017. In order to collect empirical data a diagnostic survey method was used. The research results show that most respondents declared agricultural practices and activities consistent with the concept of sustainable agriculture.

**Keywords:** sustainable development, sustainable agriculture, rural areas, education

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## **The Differences between the Counties of Lithuania**

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### **Abstract**

By using a comparison approach, this article examines the current features of differences between the regions in Lithuania. Various aspects of the environmental, social and economic differences between the regions in Lithuania are analysed and discussed. Thus analysis focuses on regional performances and changes over time. The aim of this study is to identify current pattern specific to the development of the Lithuanian counties. The methods of statistical analysis, graphic representation were used in the research. The analysed period was from 2011 through 2015. The article focuses on regional differences but also considers changes over time. The conducted analysis showed, that there was a statistically significant result of the activity rate, the average disposable income and the number of households that have an internet access comparing by the years. During the studied period these indicators (environmental/social/economical) increased in all counties. On the basis of the research it can be concluded that during the studied period there was an increase in disposable income in Vilnius County, comparing with other counties there is a weaker social situation in Marijampole County, there was an increase of ecological situation and well-being of inhabitants in Taurage County. The best possible medical care is still in university hospitals.

The results gained by statistical analysis could be used as scientific starting point in deeper understanding of the potential differences between counties.

**Keywords:** counties, regions, differences, Lithuania

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## Assessment of the Economic Viability of Family Farms in the Countries of the European Union

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### Abstract

Decline in the viability of agricultural businesses entities is a global problem. This problem has already been identified a few decades ago, the political decisions that had to change the situation were taken in the world, but the negative trends in the agricultural business are still going on, and the situation is not improving. It is difficult to describe the concept of economic viability of family farm properly, because it depends on certain aspects of assessment or objectives, and therefore, the economic viability of family farms in the scientific literature (Scott Colman, 2008; Scott Colman, 2008a; Adelaja, Sullivan, 1998; Koleda, Lace, 2009; BOSSEL, 2001) is defined in different ways. J. Scott (2005), M. Morehart (2000), J. Zeddies (1991) believe that there are many and different approaches to the economic viability of the family farm, but they can all be combined into three main groups describing the economic viability: weak, moderate or strong farms of economic viability.

The complex assessment of economic viability of family farm consist of index. Index consists of economic efficiency and solvency sub-indices. In pursuance of this objective, analysis of scientific literature and synthesis, deduction and induction as well as other general research methods were invoked. The complex index of economic viability of family farm was

developed based on previous research and operationalization method. Empirical research methodology was developed based on the analysis of the data normalization, confirmatory factor analysis, factor data analysis, analysis of correlation and regression relation as well as descriptive statistics methods.

Therefore, after the analysis of weaknesses of the assessment methodologies of economic viability of family farms in this study, the complex index of economic viability of the family farm was developed and its applicability in the EU countries was tested empirically (EU - 28). It was found that farms of weak economic viability dominated in Bulgaria, Czech Republic, Denmark, Estonia, Luxembourg, Latvia, Finland, Sweden, Slovakia, Slovenia, United Kingdom, but farms of moderate economic viability were in the rest of the European Union countries (EU-17). There is no strong economic viability farm.

**Keywords:** index of economic viability, family farms, complex assessment.

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## **Measurement of Fair Value of Biological Assets: Study on the Lithuanian Farms**

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### **Abstract**

Analysis of scientific literature and practice of accounting has suggested that there is no general consensus among the researchers and the practitioners on the value measurement method to apply to the biological assets raised and used for production of agricultural produce at the agricultural enterprises. Both the researchers and the practitioners have noted advantages and shortcomings of the cost and fair value less estimated costs to sell. In view of the background analysis conducted, the practitioners are believed to be more inclined to opt for the cost method in order to measure value of the biological assets, while the international accounting regulations (IAS 41) and national regulations in certain countries (the Czech Republic, South African Republic, Turkey, etc.) provide for only the fair value less estimated costs to sell method for measurement of value of the biological assets. The relevance of this research for Lithuania is



also supported by the fact that the accounting regulation for biological assets (BAS 17) of our country provides for the option to use one of the methods mentioned above for measurement of value of biological assets.

As part of the research presented, advantages of the fair value less estimated costs to sell method for measurement of value of the biological assets have been explored, changes in the value of the assets have been compared upon replacement of the cost method of value measurement with the fair value less estimated cost to sell method; the effect of replacement of the value measurement method on financial statements of the enterprises analysed and key relative financial indicators has been analysed. Analytical data and information on the biological assets provided in the financial statements of three agricultural enterprises have been used for the study. The choice of enterprises has been based on the intention to include farms of different specializations into the study. One enterprise specializes in milk production, another – mixed farming involving pig and milk production, and the third enterprise specializes in beef cattle breeding. All the three enterprises apply the cost method to measurement of value of the biological assets and provide information on the total biological assets held only as part of current assets.

As part of the research, balances of the biological assets of all the enterprises at the beginning and end of the reporting period and in situ data on movements within the biological assets in the reporting period have been revalued by applying the fair value less estimated costs to sell method of value measurement. The financial statements have been amended, key relative financial indicators have been calculated pursuant to the information on revalued biological assets, and the generated data have been compared to the actual data, where the biological assets were subject to the value measurement according to the actual purchase (production) cost. Results of the research has suggested that the cost of biological assets at the agricultural enterprises analysed was higher than their fair value less estimated costs to sell. Nonetheless, only one enterprise was loss-making. Change of the method for measurement of value of biological assets has led to reduction of the cost of goods sold and general and administrative expense, improvement of the performance results and profitability as well as asset turnover indicators.

**Keywords:** biological assets, cost, fair value, performance results

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## **Most Specific Inconsistencies of Labour Safety Management System in Construction Industry Enterprises**

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### **Abstract**

The study examines the role of labour safety management systems in construction industry enterprises. The study identifies the problems and influencing factors associated with implementation and maintenance of the systems. The work analyzes theoretical aspects of the safety culture, its development and choices of the labour safety culture in the organization. Requirements of labour safety legislation in the European Union are reviewed and how these requirements are integrated into Latvian legislation, and specifically in the enterprises of the reviewed sector.

The most significant inconsistencies of the labour safety management system in construction companies are identified and summarized from third-party audit reports. In order to solve the most significant inconsistencies in the labour safety management system, the necessary actions and activity are developed, which ensure the elimination of inconsistencies or minimization of their consequences, and also provide an economic benefit for the company, which is also the objective of the study.

In order to seriously think about development of labour safety culture in a company, the company management must have a sufficient understanding of its significance and impact on the quality of work carried out by the company, prestige, and customer loyalty. More attention is being paid to the social responsibility in the world. Considering the situation in the sector, entrepreneurs have to think seriously about offering their services outside the Latvian market, which means that the use of safe working methods in companies will become an increasingly important issue.

One of the company manager's helper tools is the development and implementation of the Occupational and Safety Assessment Scheme (hereinafter - OHSAS) system in the company in accordance with LVS OHSAS 18001: 2007, introducing the policies and objectives in compliance with legislation and information on occupational risks. (LVS OHSAS 18001:2007) There are relatively few companies in Latvia that choose to certify the OHSAS system. The study identifies the place and role of the OHSAS system among companies, whether it is made just to allow the company's participate in tenders of national importance, or it is used as a tool for development of its occupational safety culture. To clarify this, the most frequent inconsistencies in the OHSAS system are analyzed.

**Keywords:** labour safety, management systems, OHSAS, corrective measures, preventive measures

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## Mathematical Competences and Competence-based Mathematics Learning for Sustainable Development in Rural Areas

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### Abstract

This paper is the result of scientific analysis and assessment of scientific literature and a number of information sources taking into consideration the authors' reflection experience and observations in connection with the mathematics role in sustainable development which may be characterized by a number of factors, including, mathematical competence compliance with competencies for sustainable development as well as coherence between mathematical competence and capacity which should have new professional.

The methodology of the research is based on Danish KOM (Competencies and the Learning of Mathematics) project which set up eight mathematical competences: abilities to ask and answer questions in and with mathematics and the ability to deal with and manage mathematical language and tools. Students from Latvia University of Agriculture and Riga Technical University were asked to evaluate (using self-evaluation method) their mathematical competence by writing in the questionnaire numbers from 0 to 3, where 0 - I have not mastered this skill, but 3 - I can apply mathematical knowledge in different situations of life, I can formulate a mathematical problem, solve it. The survey results are analysed by respondents mathematics learning experience as well as needs for mathematics knowledge and skills in modern labour market conditions as well as in accordance with factor for social capital building.

**Keywords:** rural engineering, competence, mathematics, mathematical competence, sustainable development.

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## The CAP Greening Effects – the Polish Experience

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### Abstract

The European Union is directed towards agriculture and rural areas sustainable development, that is reflected in the Common Agricultural Policy instruments. Under the new direct payment scheme an obligation has been introduced since 2015 to apply agricultural practices favourable for climate and environment, the so-called *greening*. This requirement has allowed farmers to get additional support within the framework of direct payments, which was compatible with the principle of *provider gets principle*.

In the context of *greening*, many substitute agricultural practices was included, that are selected by the farmer. All farmers entitled to the Single Area Payment are obliged to implement greening, depending on agricultural surface and structure. Presently, 30% of the national financial envelope is connected with

greening. In 2015, the rate of greening payment amounted to 72 EUR/ha. Greening practices are the effect of the European Commission regulations, which indicate the importance of crop diversification in the context of soil quality improvement, the maintenance of permanent grasslands in order to ensure the carbon sequestration, soil protection and biodiversity, as well as the maintenance of ecological focus areas that guarantees biodiversity at the farm level.

The aim of the article is to present the farms` organizational changes after the introduction of greening requirements. Polish FADN data were used for 2014 and 2015. The research results indicated the farms` adaptation to greening requirements. In the short term, greening doesn` t cause negative productive and economic outcomes. In the longer perspective, greening environmental effects should contribute to factor productivity increase.

**Keywords:** Greening, the Common Agricultural Policy, Direct payments, Natural environment, Polish FADN

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## **Optimization of the Management Mechanism for the Innovative Development of the Region`s Agricultural Sector**

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### **Abstract**

Accelerating the pace and improving the quality of economic growth of individual countries over the past decades is largely due to the disclosure of the innovative potential. The traditional paradigm of extensive use of resources, natural resources, human capital, financial assets and knowledge is replaced by innovation. However, the current trends in the development of innovative activities in Russia are far from fully meeting the expectations associated with improving the competitiveness of products and the quality of life of the population, with the provision of dynamic sustainable growth, and the formation of the innovative economy. The mixed nature of the Russian

economy, the fundamentally different technological level and institutional conditions for the development of various sectors exclude the possibility of defining a single model of innovative development that is universal for all sectors. In the current conditions, the technical and technological level of the agrarian sector of the country's economy is the most catastrophically lagging behind the world's leading producers of agricultural products. Domestic agrarian production is 5 times more energy intensive and 4 times more metal consuming, and labor productivity is 8-10 times lower than in the USA, in the leading countries of the European Union and Canada. Not having eliminated this techno-technological backlog, without implementing the advanced development of certain specific areas of scientific research and technological developments in the field of agriculture, Russia's agrarian sector will finally lose its competitiveness and will not be able to ensure the country's food security. Thus, the need for a scientific justification of the theory, methodology and practice of the innovative development management of the agrarian sector of the regional economy in the context of large-scale economic and institutional transformations determines the urgency of the issue. Currently, most of the works of domestic researchers put emphasis on the problems of knowledge transfer, at the same time, the methodology for creating and commercializing competitive scientific knowledge through the formation of innovative agricultural clusters is beyond the scope of scientific research, and its management and economic mechanism has not been developed yet.

**Keywords:** agrarian sector, innovations, innovative solution, information and advisory services

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## Risk of Poverty and Social Exclusion in the European Union in the Context of Sustainable Development

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### Abstract

This paper addresses the poverty risk issues in the context of sustainable development of rural areas. Empirical materials included in this paper are based on EU-SILC (European Union Statistics on Income and Living Conditions) partial studies, and provide a reference point for comparing the EU income distribution and social integration statistics. Poverty reduction and counteracting social exclusion are among the key Millennium Development Goals. According to studies, one in four inhabitants of EU rural areas is at risk of poverty or social exclusion. While the highest shares of at-risk population are recorded in Bulgaria (54.8%) and Romania (50.8%), the levels reported by Poland and Lithuania are also above the EU average (by 4.5 and 9.2 percentage points, respectively). At the other end of the spectrum, the risk rate in the Netherlands and Czech Republic is 12.8%. For the households, income is a factor underpinning their economic safety and, thus, their confidence. The amount of incomes affects the objective poverty levels measured with a parametric method. In the EU, persons earning no more than 60% of the national median income are assumed to be at risk of poverty. Therefore, the risk of poverty affects nearly every fifth inhabitant of EU rural areas. Poverty and social exclusion are multidimensional aspects which result in unmet needs in multiple areas: healthcare, education, housing, culture and leisure. While triggering some kind of feedback loop, insufficient incomes are both the cause and the effect of deprivation of needs. Also, they provide favorable conditions for an unsustainable development of rural areas.

**Keywords:** at-risk-of poverty rate, rural areas, social exclusion, sustainable development

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## **Crossing Dichotomies and Breaking Mental Patterns: Green Business Development When All Else Fails?**

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### **Abstract**

Obtaining sustainable and inclusive societal organization is not merely a simple matter of ‘doing it’ by subscribing to some winning formula. Given that conceptual frameworks always guide our thoughts, judgments and actions (Latour, 2013; Harvey, 1996; Dennett, 1993), the ways in which we relate to concepts chosen to serve as guiding forces for future development will eventually determine its outcome. As scholarly evidence continuously suggests the concepts ‘rural’ and ‘urban’ are increasingly recognized as artificial barriers for conducting sound and integrated development endeavors in a globalized reality of interconnectedness. In line with the Sustainable Development Goals, which aim to eradicate poverty, shield the planet and safeguard prosperity for all, commitment to universal access to healthy food year round has become an important agenda point. This, however, has been exacerbated by binary thinking and separate ways of doing policy. This paper aims to share experiences from a unique project launched in the northern parts of Gothenburg, Sweden’s second largest city. While the area offers ample resources and immense opportunities for areal economies, it at the same time remains one of Gothenburg’s most segregated, with high levels of unemployment, ill health and crime. The uniqueness of the project lies not only in its way of abridging the rural-urban divide, but also by consciously deferring from the debilitating rhetoric of previous ‘immigrant policies’, and instead focusing on agricultural productivity, small-scale food producers and sustainable food strategies. Such exhortations to bridge between philosophical and material polarities, however,



have not come without conceptual and practical challenges, something this paper aims to subsume and open up to debate.

**Keywords:** rural, urban, green innovation, socio-economic deprivation, local communities.

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## Civil Defence System in Latvia and Identified Drawbacks in Riga

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### Abstract

The article considers Latvian Civil Defence System (hereinafter referred to as CD), how it works in cases of possible threats, how CS system protects the safety of people and national economy as well as the interests of the entire society in case of a catastrophe; types of CD system safety measures, provision thereof, what processes affect CD system in Riga; attitude of responsible state institutions towards national safety system and environment. Based on the abovementioned, we will review how the society itself has influenced its own safety and based on its outcome we will see what protection measures should be provided from the standpoint of safe human and social life, why the drawbacks, deficiencies and indifferent attitude are allowed in relation to the

safety system processes in the country and Riga. In the aspect of CD regulatory enactments methodology, an attempt is made to explain the current drawbacks in safety processes of tasks to be fulfilled by the municipality by means of calculations thus identifying the reasons that all emergency situations, breakdowns, catastrophes resulting from technogenic and natural risks depend on the attitude of state institutions, local governments and the society towards the safety, and on general economic situation.

**Keywords:** high hazard objects, environment protection, civil defence, disasters.

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## From Traditional to Social Business: New Possibilities for Entrepreneurs in Rural Areas

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### Abstract

In many EU countries economic and social development stagnates. The reasons are various and depends on the country. Some countries are still leaders (Germany, Great Britain, France), but depending on political events and complicated issues in each of them common EU internal market is kept as rather passive and not expanding in terms of consumption and investments. Especially it is related to countries suffering their internal business problems. The research problem of this paper is related to the issues how to provide some innovative solutions to traditional enterprises in Lithuania and Poland for their prosperous

development. The aim of the paper is to analyse the situation and problems of traditional business in rural areas of Lithuania and Poland and propose development possibilities applying social initiatives and becoming social enterprises. The research object of the paper is traditional and social enterprises in rural areas. The main tasks are: to analyse the situation of traditional business in Lithuania and Poland focusing on rural areas; to present and explain possibilities and advantages of diversified activity becoming social entrepreneurs; to propose concrete step plan for traditional enterprise how to become social enterprise in legal, economic and social environment depending on the country: Lithuania and Poland.

**Keywords:** Business, Social Business, Entrepreneurship, Entrepreneurs, Lithuania, Poland.

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## **Economic Aspects of USA Investments to the European Union Member States**

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### **Abstract**

The EU and the US are the biggest economic and military powers in the world, despite the lack of a common EU defence policy. They dominate global trade, they play the leading roles in international political relations and what one says matters a great deal not only to the other, but also to the rest of the world. And yet they have regularly disagreed with each other on a wide range of specific issues, as well as having often quite different political, economic, and social agendas. The international relations of EU and US are based on some basic points such as economy, politics, law and culture. All of them are connected

and no one should be omitted while communicating. In order to maintain good relations between EU and US special attention must be paid on these four points of partnership. Thus, various agreements, meetings, contracts, protocols and etc., require mutual understanding between both sides and understanding of the cultures gradually became an integral part of the communication. Regarding that, the problem examined in the research paper is how economic aspects impacts foreign direct investments to the EU member states? The outcomes of the research is significant and relevant, because it can contribute to further research related to investments and their trends. The aim of the article is to investigate the economic aspects of USA's foreign direct investments to the EU member states. The object of the analysis is USA's investment partnership with the EU. The tasks of the article are: to identify the specificity of EU investment policy with USA; to make the research in order to classify economic investment fields in the EU member states; to generalize the main investment trends in EU member states. The following research methods are applied in this research paper: literature review and synthesis; descriptive analysis of the current investment situation from US to EU, partnership investment challenges, problems and trend; systemic – quantitative analysis of statistical data. The problem examined in the research paper – how economic aspects impacts investment from US to the EU member states. There are identified TTIP role and specificity of development in bilateral USA-EU relations, later examined agreements and legal basis affecting exports from USA to EU. Classified and investigated the main USA-EU investment trends. Generalized the main aspects of investment trends from USA to EU.

**Key-words:** foreign direct investments, USA, European Union, TTIP, EU – USA investment trends, economic aspects

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## **A Comparative Investigation of English Language Proficiency and Academic Performance of Current Undergraduate Students with Special Reference to Generation Z: Rural *versus* Urban Students**

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### **Abstract**

Understanding the audience is the key to successful communication. Therefore, an effective teacher has to consider manifold differences among the students in any given classroom: the characteristics of the students, the mind-set of the generation, the variety of learning styles, the students' needs and goals, and their educational background. Since Aleksandras Stulginskis University (ASU) awards the degrees in food sciences, agriculture, forestry, water and land resources management, bioenergy and mechanical engineering, climate change and sustainable use of natural resources, a sizeable part of the students come to study from rural areas. Recent educational research in the USA, UK and Lithuania have revealed a significant difference in the academic performance of the students from rural and urban areas, however, it is still an unresolved problem for the educational institutions in Lithuania. This area has an insubstantial amount of research documented. Thus, the current research aims at investigating the relationship between the location of the school, a student graduated from, and the results of the English language diagnostic test as well as analysing the academic performance of the Agronomy Faculty students through the 2nd, 3rd and 4th semesters. The study focuses on our current undergraduate students - the always-connected, app-happy, smartphone-dependent, born with the Internet, technology, and social media generation Z. The research methods involve statistical and comparative analyses of the urban and rural student achievements in the English language; the theoretical assumptions based on the documents from the National Examination Centre, the Ministry of Education and Science, The National Centre for Education Statistics, and the Eurydice Network, and the investigation of motivational factors influencing the academic performance of the generation Z students in line with the survey results. The research findings indicate that students from rural schools have an inferior level of the English language compared to the students that finished schools in urban areas, whereas the examination results through the second, third and fourth semesters unveiled an unexpected tendency. Figures show that students from rural schools not only managed to

catch up with their colleagues from urban schools, but also outperformed their urban-school peers by roughly increasing rates of their performance. The research evidence could aid teachers and education policy makers, providing a better understanding of generation Z students from rural and urban areas, factors influencing students' performance and contributing to more effective selection of strategies and resources for teaching ESL, adapted to the needs of generation Z students.

**Keywords:** *rural, urban, English Language Proficiency, generation Z.*

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## **Rural livelihood transitions: towards an integration of the Sustainable Livelihoods Approach and the Multi-Level Perspective**

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### **Abstract**

In response to evolving challenges, rural livelihoods have to diversify to include new on- and off-farm activities of households. However, sustainable livelihood concepts have so far not sufficiently accommodated transition dynamics. Mostly, rural livelihoods and sustainability transitions are addressed separately in the scientific literature. This review explores opportunities to integrate the Sustainable Livelihoods Approach (SLA) and the Multi-Level Perspective (MLP) on transitions. We provide an overview of the SLA and MLP and summarize earlier applications of transition concepts on rural livelihoods in the literature. We then focus on the conceptual linkages between SLA and MLP, in particular regarding livelihood diversification strategies. Our review shows that the conceptual overlaps of SLA and MLP allow for a meaningful combination of both approaches to harness their respective strengths. Vulnerabilities from the SLA perspective (e.g. shocks, trends, changes) are considered at the landscape level in MLP. Policies, institutions, processes are part of the so-called

regime in the MLP heuristic. The livelihood diversification in SLA, e.g. the development of new on- and off-farm activities, can be described as niches in MLP. Some empirical work on agricultural transitions from the MLP perspective has adopted a territorial approach to take into consideration the pluri-activity of farms and the interactions between different subsystems (food, energy and tourism). This resonates well with the idea of livelihood diversification as a strategy in SLA. We conclude that integrating SLA and MLP will help to better understand livelihood diversification processes and we provide a preliminary proposal for a livelihood transition framework.

**Keywords:** Sustainable Livelihoods Approach, Multi-Level Perspective, Sustainability transitions, Livelihood diversification.

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## **Innovations for Rural Development – New Media and Participatory Governance**

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### **Abstract**

The aim of the presentation is to analyse the role of new media (using the Internet) in communication with inhabitants in the rural community and their involvement in decision-making processes. Both the use of modern communication tools and participatory management can be treated as

innovative solutions that can contribute to local development. The development of the information society and civil society are defined as priorities in development strategies both at national and local level.

In the presentation the following issue is discussed: whether modern forms of communication are an element of participatory management, leading to an increase in the inhabitants' involvement in the community's affairs and their influence on local policy. It is based on the case study of the selected rural community. The object of analysis were firstly instruments and communication channels used in the information policy by the local authorities. Secondly, the level and scope of social participation in rural community were studied on basis of the existing data and the results of a survey conducted among the inhabitants of selected villages in the community. The presented results were obtained within the research project "Models of management and the determinants of their functioning in rural communes" , financed by National Science Centre, Poland (UMO-2014/14/E/HS6/00398).

**Keywords:** participatory governance, social participatory, information policy, local community, innovation for rural development, new media

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## The Pros and Cons of the EU Common Agricultural Policy

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### Abstract

The Common Agricultural Policy (CAP) of the European Union has generated a great deal of attention and controversy among research community, practitioners and the wider population. The aim of this study is to overview and to discuss the thoughts and comments on the CAP which have been addressed by both its proponents and its opponents in the scientific publications, political



commentaries, official reports, public opinion surveys and social-media-based public forums.

While on the one hand, recent public opinion poll (Eurobarometer 2016) indicated broad support among EU citizens for the CAP; on the other hand, other sources give some strong arguments in favor of reducing or even scrapping the CAP.

The CAP supporters (including European Commission itself) highlight, among others, the benefits of this policy (environmental; cultural; social vitality; food variety, quality and security; maintaining of rural employment, etc.) for all European citizens and not only for farmers, while CAP opponents stress its unfairness both to non-farmers (e.g. huge financial costs of its policy for taxpayers) and small farmers (large farmers benefit most), heavy administrative burden for farmers as well as the CAP's destructing impact both on the EU states' agriculture systems and developing countries' agricultural markets.

The CAP is basically the same for all EU member states but the EU countries differ considerably in terms of their rural development. According to some views, the CAP does not fit Central and Eastern European countries. It represents a failure of the EU to adjust adequately from an exclusively Western European institution into a proper pan-European organization.

**Keywords:** EU, Common Agricultural Policy, advantages and disadvantages

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## **Innovative Implementation of Management Functions in the Context of the Concept of Collaborative Governance in Public Administration**

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Aleksandras Stulginskis University, Lithuania

### **Abstract**

Constant and intensive change of the environment is accompanied by humans' growing needs, implementation of innovations, development of new

technologies, need to explore for options of more transparent government, promotes change and development of new models and ideas of public governance that would emphasize the principles of cooperation, openness, transparency, and good governance. The aim of research is to discuss public sector innovations in governance in the context of connected governance concept. The research object is - innovative implementation of management functions in the public sector. The paper is based on the scientific literature and documents (laws) analysis and synthesis, systematization, case studies and comparative analysis, visualization methods.

The new concept of public governance as a science – public governance (as the right and duty of the institutions mentioned) centres on interaction and processes, which also cover civil society, rather than on the authorities (Bevir, 2010). Regardless of the increasing focus on public governance, there is still lack of systemic approach towards the proper definition of interaction (cooperation) and connected (collaborative) governance in the public sector (O’Leary and Vij, 2012).

Connected governance lays grounds for various stakeholders (including participants of the public, private, and social sectors), who participate in innovation networks, to join their efforts, address issues, work towards not only individual or organisational goals, but also receive added value, common benefit in the form of empowerment of the principles of flexibility of social learning, social capital, and innovative activity and use of key mechanisms of connected governance.

Management is becoming an integrated, multifunctional system of governance and interaction between the stakeholders.

Improvement of the modes of interaction may bring benefit to management of the planning process. Interactions between structures and processes in the management system demonstrate the mechanisms of performance and connections, and institutions of public governance should therefore be viewed as the collaboration by interaction network of networks. the method of change management either reduces or increases trust in leading, and interactive collaboration, employee participation and leadership communication therefore contribute to trust among employees, better performance results, and achievement of the organisational goals.

**Keywords:** collaborative governance, innovation, management functions, public sector.

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## A Lateral Approach to Ethics in Business

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### Abstract

Ethical issues in enterprises are often discussed in the scientific studies. Most of them describe organizational ethics from the perspective of corporate social responsibility or its impact on the behavior of employees in the organization. The authors decided to depart from the schematic formulaic thinking of ethics as a set of normative values for a purely business approach. Looking for opportunities to use organizational ethics in promotional activities or when determining the value of goods and services.

The aim of this article is to present selected approaches to ethical issues in the organization and to present the results of authors' our research. The Authors in their study use research methods such as literary research and primary research using the survey tool. Surveys were conducted in Poland in the period from January 2017 to October 2017 and they included a random sample of respondents. The main hypothesis was also formulated:

H0: Ethics in the enterprise can be purely binary,

For the purpose of the study, the following hypotheses were formulated:

H1: Ethics can be used to shape prices

H2: Ethics affects consumers' decisions

H3: Unethical behaviors in the enterprise worsen, its competitiveness

In addition, this publication underlines individual moral considerations of the ethical aspects of using ethics in the enterprise to increase profits and thereby create a paradox of unethical use of ethics.

**Keywords:** ethics, promotion, management, strategy, communication

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## The effectiveness of Human Resources Management

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### Abstract

Everything formed in the company including products, services and all ideas are created by human. Therefore, human capital is one of the most important resources of an organization and source of achieving company's success. The relation between employee fulfilment, satisfaction of their work and their effectiveness, commitment, performance and identification with the organization seems to be obvious. The goal of the paper is to present the review of the literature in the field of human capital management and the cognitive purpose is the analysis of the implementation of selected elements of human resource management and most of all methods and tools that improve the performance of employees. The research method was a survey carried out among the selected employees in Natures Way Food – organization based in Southern England, West Sussex. The study involved 100 randomly selected employees of Natures Way Foods. As a method of data collection was used the auditorium questionnaire consisting of 30 questions carried out in the workplace of surveyed people. The survey was anonymous and its results served for conclusions and proposals for changes in the implementation of HR processes, affecting the efficiency of employees.

**Keywords:** human resources



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## The Role of Tertiary Education in Regional Development in Conditions of Slovak Republic

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### Abstract

In addition to the infrastructure of the regions, an essential aspect of their development is their educational structure and the demographic potential according to the predominance of the age composition. The education is basic mean for acquiring expert knowledge, which affects human capital of the labor market and professional mobility and adaptability of human resources at the labor market. It is important to educate university graduates for practice by using appropriate and suitable educational methods. In Slovakia the share of inhabitants with the university education is increasing. This group represents the development potential of the regions. Great possibilities are in the training of a new generation of graduates for different field of regional development. Therefore, it is important the educational structure and also the active working and networking of universities with other actors in the region. The objective of this paper is focused on tertiary education and study programs for regional development. We will analyze the development of number of students at universities with regard to the individual levels of study (bachelor, engineer/master and PhD.) and study programs within the individual regions of Slovak Republic. The evaluation of the obtained data will be made by using the methods of comparative statistics.

**Keywords:** tertiary education, study programs, students, regional development, labor market



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## Smart Growth in Latgale region of Latvia: an overview of multiple-helix actors

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### Abstract

Within the framework of Latvian National Programme EKOSOC-LV this paper focuses on the smart growth as a tool for regional development. One of the most important aspects of the implementation of the concept of smart specialization is the involvement of all involved actors, hereafter one of the solutions of smart growth evaluation is the multiple helix approach. By analyzing and summarizing the aspects affecting smart territories, based on the theoretical principles, regional actor's (local governments, entrepreneurs, representatives of communities, scientists) recommendations, taking into account the national strategic settings and the views of the EKOSOC-LV working group, developed the smart growth index as well as factor hierarchy of the smart territory formation and growth, on the basis of which the Analytic Hierarchy Process method was realized. There is the new Smart Development Index was created and the method of Analytic Hierarchy Process is used. Complex analysis of the obtained quantitative indicators highlights the *Population* and *Resources* dimension, but qualitative assessment underlines *Population* and *Economy* dimensions as the keystones of the smart specialization of the Latgale region. The integrated application of quantitative and qualitative approaches allows a

comprehensive assessment of the smart growth process in the Latgale region and its districts.

**Keywords:** multiple-helix, Latgale region, AHP, smart growth index

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## **Comparative Study on Adult Mathematical Competence in Baltic States in the Context of Sustainable Development**

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### **Abstract**

Background rationales of the study based on the need to understand and ability to use mathematics in everyday life and in the workplace has never been greater and will continue to increase. Mathematics is a discipline, which is a background for specialists who works in environmental protection, engineering, construction, business, telecommunication, textile, new energy sources, etc. Mathematical competence is one of the eight key competencies defined by EU Directives, which include the skills to apply basic mathematical principles and processes in everyday contexts at home and work, and to follow and assess chains of arguments. An individual should be able to reason mathematically, understand mathematical proof and communicate in mathematical language, and to use appropriate aids. In the framework of this study criteria justifying

the role of mathematics in workplace and everyday life were developed and implemented, as well as identified the mathematics knowledge level what is needed for particular company / institution's employees as well as evaluated the employees' professional competence. In the study made the comparative analysis of the employees and employers' needs and fields of the deeper knowledge of mathematics that need for the specialists to accomplish their professional activities successfully. The study analysis also the respondents' willingness and motivation to improve mathematics knowledge/ skills and describes how to organize continuing math education by the use of the basic math knowledge/ skills/ competence, competence field, company profile as well as gives comparative analysis of the opinions in different Baltic States.

**Keywords:** mathematical competence, sustainable development, employers, employees

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## **Comparison of Slovak Dairy Products with and without Added Value Sold by Commercial Chains**

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### **Abstract**

The share of products with higher added value is constantly decreasing in Slovakia's agri-food exports and the share of basic agricultural raw materials with low added value is increasing. Commercial retail chains sell especially



products without added value. On the other side, products that have undergone a processing are imported from abroad. According to the latest survey of the Slovak Food Chamber of Agriculture in 2016, the share of Slovak products on retailers and retail chains is only 39.91%, with 38.9% in 2015 and 2014. with increase of only 1%. Most of the agri-food products produced in Slovakia are at most represented in commodities: eggs, milk, honey and at least in the following categories: processed vegetables, packaged meat and processed fruit. The main objective of presented paper is to show, that Slovak farmers rather sell raw milk instead of selling added value processed products. A big difference can be found between milk and dairy products, where up to 20% is the difference in the representation of these products in the commercial chains. This fact means, that the Slovak farmers produce enough milk, but it is cheaper for them to sell milk as a raw material instead of processing it in their own direction and selling the processed products. Raw material is exported abroad and then comes back to the Slovak market with an added value as processed product. The survey, which was carried out on all trade chains, showed that the share of Slovak milk in the chain is 63%. An important finding is also the presence of individual dairy products that are produced in Slovakia. The result of the survey showed that the largest share of Slovak dairy products in the domestic market is 51% cottage cheese and sweet / sour cream 55% lowest ripening cheese 40% and processed cheese and cheese spread 43%.

**Keywords:** milk, dairy products, commercial chains, added value, raw material

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## Support Tools for Production of Environmentally Friendly Primary Products in Latvia

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### Abstract

Organic farming is part of the national economy where renewable natural resources are used in a sustainable and prudent way in the production process, and therefore the production of primary products is environmentally friendly. Latvia has a high potential for growth on the basis of the EU as a whole - in 2016, the area of biologically certified territories occupied 237.6 thousand hectares, or about 11% of the total agricultural land, which is the fifth highest producer among the EU member states. The aim of the study is to analyze the availability of support tools in the organic farming sector and ways to improve their use efficiency. The available support tools contribute to increase in the number of farms and to increase the size of the agricultural land as well as rising productivity and a better level of mechanization. Less important is the development of bio-processing and the provision of a complex production cycle. Support for organic farming partially compensates for the loss of profits, but does not include support measures directly addressing the problems faced by farmers - biological seed, certification fees, animal breeds, public awareness.

**Keywords:** organic farming, support tools, sustainability

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## Scope and Determinants of Women Participation in Management of Local Authorities in Rural Areas in Poland

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### Abstract

According to statistics, women are underrepresented in different kinds of decision bodies in economy, politics, sciences etc. The average for EU proportion of women in the group of local government leaders is amounted at 15%. For Poland the figure is much lower. It indicates the severe problem with women promotion to the top positions in different political or administrative organizations. The aim of the paper is to evaluate the scope and determinants of women participation in local governments in rural areas in Poland.

The analyses of the problem are based on information and data from Ministry of the Interior and Administration Office and websites of the basic administrative units in Poland called *gmina*. Detailed analyses are carried out on the sample of 5% selected randomly rural *gminas* headed by women and 5% of such *gminas* headed by men.

Descriptive and comparative methods are the main methods of the investigation. They are supported widely by quantitative analysis.

The analysis indicated low women participation in top positions in governing bodies of local communities in Poland. The lack of differences in women role in communities in rural and urban areas is very interesting result. It suggests the important changes in rural society in Poland. The bigger role of women in rural *gminas* was observed in the west part of Poland. *Gminas* managed by women are rather smaller than *gminas* administered by men. What is interesting, in many *gminas* the position of women at the village level is higher than at *gmina* level. Moreover, the investigation showed that in rural *gminas* women prevail in important back-office positions like main secretary of the *gmina* office and chief accountant. It seems that the concept of labyrinth can be applicable to the situation of women in decision making bodies in rural areas in Poland.

**Keywords:** local governments, women in management, glass ceiling, rural areas, rural *gmina*

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## **The Rural Pupils' Opinion About the Development of Rural Areas and Sustainable Management Opportunities in Latvia**

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### **Abstract**

The results of the previous surveys indicated that the inhabitants of rural areas prize the value of nature in their place of residence but do not see the possibility to develop various business facilities. However the opinion of the younger generation (pupils of local schools) about sustainable management and preservation of the nature has not been analysed so far.

The aim of study was therefore to study the level of social awareness of children living in rural areas on sustainable environment issues.

Method chosen was several discussion-lectures on sustainable environment issues that were organized during March-April 2017 in 5 rural areas (~ 150 pupils from 5 to 12 classes).

In general the students' opinion on environmental and social awareness indicated that children are more motivated to take active role in protection of environment even if it is not yet clear what profession they will choose in the future. Moreover, most of them are aware of the importance of ecosystem services in their lives as well as their impact on nature. Children were able to appreciate the natural beauty, clean and noise free environment and wanted waste free places of residence and surroundings. Most of them indicated that they intend to keep their family home as a holiday home in future to stay in contact with their childhood area. It was also found that the interest of children in agriculture derives from their family's core activities in this area indicating that there might be successful future scenarios in this area concentrating on development of ecological and economically sustainable innovative farming.

It is very important not only to create job place or proper conditions for development of business opportunities and clean environment with good infrastructure but also to think about sport, culture and entertainment events to attract the younger generation to their place of residence instead of leaving.

Therefore municipalities have an important role to play in attracting new, sustainable, well-educated, well-motivated young people to the rural areas.

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**Keywords:** rural pupils' opinion, sustainable development, environmental and social awareness

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## **The Development of Cross-Border Relations in Rural Areas (On the Example of Local Border Traffic)**

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### **Abstract**

The paper aims at presenting to answer: can cooperation within local border traffic (LBT) be a platform for cross-border relationships in rural areas? Rural areas located in the border zone were subjected to analysis, limiting the study area to the Polish Warmia-Masuria Province and the Kaliningrad Oblast of the Russian Federation. For the needs of the present task, survey studies were designed and carried out, targeting rural governments and their inhabitants of 13 districts (powiat) of Warmia-Masuria Province (rural areas) covered by the Agreement on LBT on the Polish side, as well as respondents residing in the Kaliningrad Oblast on the Russian side. Individual interviews represented the basic research method in data collection. The interview questionnaire was the research tool applied. As results from the carried out surveys:

As results from the carried out surveys:

cross-border relationships on rural areas within LBT expand economic innovation, infiltrate social and cultural influences, overcome negative

stereotypes, and reinforce cooperative habits. Furthermore, they support the development of additional cross-border cooperation area.

**Keywords:** rural cross-border areas, cooperation, cross-border relations, local border traffic

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## **Reverse Mentoring Peculiarities in Vocational Teacher Training: From Model Boundaries to Emancipating Partnerships**

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### **Abstract**

This research paper provides information about sustainable mentoring strategy based on the idea of reverse mentoring while training future vocational educators. The research was conducted in vocational education centers. It involved 24 pairs of mentors and mentees who were participating in pedagogical practice, based on the implementation and management of pedagogical innovations. The research sought to determine whether the reverse mentoring strategy is an effective avenue for co-construction of knowledge among experienced teachers – mentors and future vocational teachers. Research data were acquired while participating in mentor – mentee discussions and analyzing mentees' written reflections of innovation practice. The research data were analyzed according the guidelines of the qualitative research paradigm. Through qualitative discourse analysis there was identified the system of qualitative categories and subcategories that revealed mentors' motivation to meet their mentees' immediate needs while plunging together into the process of acquiring and studying relevant resources, strategies, and ideas in order to

enhance instruction and teach how to manage educational innovations, improve content and pedagogical knowledge through reflection and collaboration. Reflection and collaboration highlighted the immerging reverse mentoring issues: experienced teachers – mentors growing motivation to share knowledge with their mentees, not only by presenting mentors’ models for vocational education activities, but also while learning from their mentees. The research findings concerning mentees factor in reverse mentoring process support the fact (Augustiniene, Ciuciulkiene, 2013) that the future vocational teachers (mentees) alongside with the development of their professional competencies have learned how to manage their own prejudice about mentor experience priority and challenge senior persons’ attitudes, have become open in real learning environment, developed a dialogue with their mentor and got more self-reliant in their pedagogical solutions.

**Keywords:** vocational teacher training, mentor, mentee, reverse mentoring  
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## **Bioeconomy and Sensible Management of Natural Resources: Farmer’s Social Responsibility Approach**

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### **Abstract**

In recent decades the wellbeing of society had been more and more often placed next to the issue of increasingly depleting natural resources worldwide and successive environmental challenges. Climate change, pollution, destruction of natural habitats, loss of species, collapse of whole ecosystems, degradation of urban and rural settlements and many other challenges accelerated the holistic approach to be increasingly taken into account in scientific and political discourses. Political agenda of the EU and its Member States had highlighted the power of bioeconomy in solving the issue due to its more holistic perspective on the interconnectivity between sectors. Exceptional consideration in this approach had been given to sensible management of natural resources as

forward-looking activities. Food security and sustainable agriculture use to be listed among the most challenging fields in bioeconomy. At the same time sensible management of natural resources is highly interconnected to social responsibility of farmers despite the lack of research.

The main aim of this paper is to explain farmer's social responsibility from sensible management of natural resources point of view. Systemic analysis and synthesis of scientific literature and theoretical modelling methods were applied to describe the concept of sensible management from social responsibility perspective. Survey method was applied to measure farmer's social responsibility when managing natural resources as a public good sensibly. Representative empirical study was performed in Lithuanian farms.

The gap of scientific knowledge and evidence in sensible management of natural resources from social responsibility point of view was observed. Empirical study proved the need for further in-depth analysis of the existing interconnectivity among farmer's social responsibility and sensible management of natural resources as a public good.

**Keywords:** bioeconomy, social responsibility, natural resources, public good, farmers

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## Institutional Framework of Government Support for Ukrainian Farms

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### Abstract

The study aimed to explore the current situation and services efficiency level of problems of Institutional framework of government support for Ukrainian farms.

Nowadays, the agrarian sector of the economy shows a positive dynamics of growth, forming in recent years about 14% of gross value added in the country and about 40% of foreign exchange earnings on exports in Ukraine. This article aims to examine, through content analysis and statistical description, the importance of the agrarian sector in the national economy and its role in ensuring the country's food security requires the sustainability and effectiveness of its development based by experiences of USA and Europe practices.

Therefore, the study examined the development of farming and service cooperatives are the necessary actions of the state, aimed at ensuring that a person working on the ground can earn enough money to be interested in continuing the work on his own land.

Research data were collected from State Statistics Service of Ukraine, World Economic Forum and The European Statistical System.

Research results showed that creating new jobs in the countryside are taxes to local budgets, and the development of rural areas, and the slowdown of urbanization, the reduction of the rate of extinction of the Ukrainian village. Such economic results, supplemented by the solution of other problems that farmers say, will obviously be better prepared for the opening of the land market in the future.

**Key words:** governmental support, Ukrainian farms, land market, state aids, rural development.

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## **Conceptualisation of the Meaningful Life Among Rural and Urban Youth**

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### **Abstract**

In a rapidly changing global environment young people find it more difficult to understand and take a position in life. Therefore, the insights into the meaning of life as well as youth values, which need to be updated at times, presuppose a scientific problem of this work. The article aims to elaborate the differences between the rural and urban youth concerning their perception of the meaningful life and their values. Three hundred and seventy undergraduate students in the study programmes of agriculture, technology and social science at Aleksandras Stulginskis University were surveyed. The results of the survey revealed the prevailing individualistic values of the youth. Although the statistical differences in the socio-economic variables were not found, some trends in the context of gender, field of study, and place of origin were observed. Students associate the meaning of life with diligence and honest work, self-confidence and goal-seeking. The essential differences in basic life principles manifested themselves within the perception of the meaningful life between the urban and rural youth. Although young people from rural areas perceive life as tedious, they tend to live longer, abandoning everything that is unhealthy, and do not think that a suicide could be a way out of a difficult position. Whereas, the youngsters from big cities, evaluating their life in a fairly optimistic way, would rather live shorter life, than give up the pleasures of life; they are also more likely to think that a suicide could be a way out of a difficult situation.

**Keywords:** meaningful life, youth, values, urban, rural.

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## **The Impact of Biofuels Production Development and Prices of Resource**

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### **Abstract**

The assessment of biofuels from an economic point of view reveals the interactions between biofuel production volume and prices of the plants. These interactions are subjects of scientific discussions, as the increased demand of crops is likely to increase their price according. From the social aspect, the increase of crops' price may be assessed in two ways - on the one hand, it would increase growers' income and, consequently, the social well-being, biofuels production may reduce the availability of food. From the environmental point of view, biofuels production should reduce carbon dioxide emissions into the atmosphere, however, the process of biofuel production consumes large quantities of water, which can be very valuable in supporting the biodiversity of a certain region, besides, timber harvesting may increase and, consequently, the absorption of CO<sub>2</sub> will decrease. The purpose of the article is to prepare the research methodology assessing the impact of biofuels production development in terms of resource prices in the EU countries. The performed multi-dimensional regression analysis allows stating that the development of biofuel production during the research period, from 2003 to 2013, did not have significant impact on the prices of food and feed plants, although a strong or very strong relation exists between the price of food and feed plants and production volume. Regression analysis revealed that when more factors are involved instead of just biofuel production volume, the changes in ethanol or biodiesel production volume have less impact on the price of feedstock plants than, for instance, oil price. The completed research revealed that there exists a relation between grain price, oil price and biofuel production volume, but the prices of food and feed grain are influenced by oil price rather than biofuel production volume, and, knowing that grain price is affected by many other factors, such as crop yield, climate, etc., it may be claimed that the development

of biofuel production does not have significant effect on the prices of food and feed plants.

**Keywords:** biofuels production, prices of resource.

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## **Global, European and National Drivers of Lithuanian Bioeconomy Strategy**

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### **Abstract**

The need of Lithuanian bioeconomy strategy is influenced by global, European and national drivers. Using content analysis the main global drivers were identified: increasing population, depletion of natural resources, increasing environmental pressures and climate change.

The drivers at European level were identified using EU and OECD documents' content analysis and the analysis of case studies in European countries. The analysis revealed that scarce biomass should be used under four principles: 1) giving the priority to food security; 2) combining food security with sustainable use of renewable resources for industrial purposes and assuring the environmental protection; 3) applying the cascading principle in the biomass value chain, first of all using biomass in the production of the highest value added products; 4) achieving multiple use of biomass, i.e. developing circular economy. Cascading principle will lead to the formation of winners and losers,

often in the same subsector, thus creating the highest possible value added will require a targeted, goal-oriented policy. The analysis of good practice in EU countries showed that there are following trends in bioeconomy: use of waste as biomass; integration of bioeconomy subsectors; use of biomass in the production of high value added products; replacement of one type of biomass by another; search for alternative forms of biomass; development of circular economy. The mentioned principles and trends are the main drivers of bioeconomy strategy. Industrial biotechnology will become the cornerstone driving force of the development of bioeconomy sectors. The analysis of bioeconomy strategies and policies in the Baltic Sea Region countries also revealed that Lithuania needs a bioeconomy strategy, which would speed up the sustainable growth and development of this region.

The statistical data analysis showed that since 2010 Lithuania has been among leaders of bioeconomy growth in the EU in all biomass production and fully bio-based manufacturing subsectors, also, has a good research and development potential in the field. Identified subsectors are closely interrelated, because several activities use a part of the same biomass, while bio-products of one subsector become bio-resources of another subsector.

**Keywords:** bioeconomy, strategy, drivers, biomass, cascading principle, circular economy, food safety, sustainable use.

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## Characteristic of the Agricultural Sector and its Infrastructure of the Selected Country

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### Abstract

The agricultural sector occupies a special place in the structure of the economy. The article presents the comparative characteristic of this sector and its infrastructure in selected countries. The main problems related to agriculture are presented. Also, it is listed possible ways to resolve them.

**Key words:** Agriculture, infrastructure formation, problems of agricultural business, ways of development and improvement

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## The Counterpoint of Earth and World Meanings in the National Identity‘ Expression

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### Abstract

The meanings of the earth and the world can be associated with issues of national identity. In the article, the issues of fostering national identity are discussed in the context of M. Heidegger's philosophy's outlook on a land and world disputes. The article tries to define how much a nation can be an object of scientific cognition. Understanding the nation as a resistance to limiting objectification is a **methodological background to the development of the topic**, which obliges the philosophical interpretation of the problem to be trusted, at least as a scientific reduction

of the problem. Sketches of the earth and the world are used as a kind of catalysts of intellectual imagination and methodological guides.

**The main aim** of the article is the attempt **to analyze the conditions of the expression of the national identity** in terms of both the subject matter and the non-objective reflection, not contradicting each other, but from the point of view of complementarity and consistency, what is meant by the term "counterpoint" borrowed from the theory of music. The collision of national identities through Martin Heidegger's typology of expression images has not been examined. There are also discussed the untapped reserves for nurturing Lithuanian identity - both spiritual and economic. The aim is to refine the political awareness of the model of the Public Treaty raised by the Enlightenment thinkers.

Land is an important factor in the economic development of a society and the object of economic exploitation, but, more importantly, it is a standpoint in establishing and maintaining the nation's vitality. The dispute between the earth and the world which foster the thesis of national identity acquires the essence of the truth of being.

**Keywords:** : earth, world, nation, identity thesis, public contract, state.

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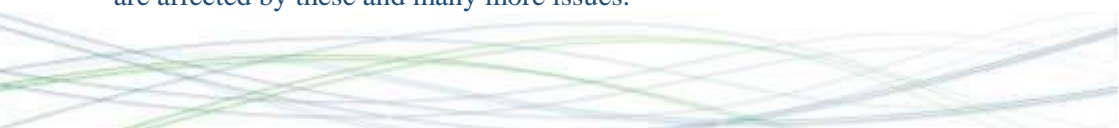
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## **A Multi-disciplinary Approach to Social Innovation at the Grassroots Level in Rural India- A Case Study**

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Rajasthan Technical University, India

### **Abstract**

Despite huge amount of information available to us, and even with huge infrastructure and technical knowhow at our disposal, the world community stares at some stark problem. Social problems like hunger, malnutrition, climate change, lack of potable water, social and financial security of women, unequal distribution of wealth are global in nature. Societies in different part of the globe are affected by these and many more issues.



These core issues demand that people should come together from different fields to address them. The approach has to be such that a fine balance between market economics, social welfare and cultured continuity can be maintained for a lasting solution.

In the present course work we shall brainstorm on these aspects of social innovation with help of some case studies from agriculture sector in India and Asia.

**Keywords:** Social Innovation, Multi disciplinary approach, Agricultural innovation

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## Organic Farming as a Part of the Sustainable Development of Agriculture

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### Abstract

The paper presents the relationships of organic farming with sustainable development of agriculture and rural areas. The promotion of environmentally friendly agriculture and environmental protection are implemented within agri-environmental programs. The aim of these programs is to achieve sustainable rural development and preserve biodiversity.



The goal of studies was to assess the sustainability of ecological agriculture at the level of an agricultural holding. Organic farming is perceived as a system that is most favorable from the perspective of environmental protection. Analysis was conducted on the basis of data from ecological farms in the Podlaskie voivodeship registered in the FADN system in 2014. Ecological indicators (share of cereals in crops, vegetation coverage of the soil throughout the year, stocking density, balance of organic substances, agricultural and environmental actions taken) as well as economic indicators: land profitability and productivity and profitability of labor, were accounted for. It was determined that the conditions of environmental sustainability were met with regard to the majority of ecological indicators. From the perspective of economic effects, organic farming achieved a positive financial result, but it was lower than in conventional farms. This result was achieved thanks to public subsidies for ecological production.

**Keywords:** agriculture, ecological indicators, organic farming, sustainability

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## **The Role of Rural Development Administrators in Rural Institutions**

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### **Abstract**

Changes in rural development policy effected by globalisation, increasing competitiveness of the regions, quick development of technologies and their intervention to daily life challenges new requirements for society. In rural areas where the life is not so quick, but social problems are deeper, there is a need for urgent, pro-active and professional area orientated development decisions. Due to challenges posed to agriculture by economic globalisation and sustainable

development, both theoretical and applied scientific research is necessary to improve agricultural and rural development policies and their management. This demand for professional and innovative activities in the area of rural development is significantly bigger than in the other sectors. Following this specific attention is given to the role and functions of rural development administrators, how they change and affect the functioning of rural areas. According to mentioned *the research object* – functions and role of rural development administrators. *The research aim* – to explore the functions and role of rural development administrators in rural institutions. The research is based on the positive research paradigm, content and descriptive analysis, empirical study methods, logical and systematically reasoning, abstracts and other methods. The questionnaire about the role rural development specialists/administrators in rural areas was made using 13 open-ended and open questions. Different questions were given with the purpose to identify what type of institution represent respondents, what are or could be the competences of rural development administrators, what level of education they have/or expect to have, what type of model should be applied to enhance and maintain rural development study programmers. To evaluate the role of rural development administrators, three groups of experts were selected (professionals, NGO and governmental organisation leaders). Their opinions enabled to do the comparison of assumptions regarding the behavior of rural development administrators, their participation in the rural development management process. Rural development administrators are integral to the operations of all rural municipalities, local action groups and other rural institutions. Rural development administrators implement regional policy, take care of the welfare of the rural community and the identity of the area. They are rural entrepreneurs, specialists of state and municipal institutions who analyze, evaluate the rural development environment, rural and regional resources, predict socio-economic changes in rural areas and prepare strategies, programs and projects for managing socioeconomic change. They are local self-government experts, experts in innovative management techniques, and professional breakthrough makers. They contribute to the overall sustainability of the community.

**Key words:** rural development administrators, innovations, rural development policy and management.

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## **The Model of Integrative Management of Rural Social Infrastructure Development**

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### **Abstract**

This article describes integrative management of rural social infrastructure (hereinafter referred to as the RSI), provides the analysis of RSI management processes and determination of main principles required in order to achieve sustained development of the region. The main research objective, namely, creation of integrative rural social infrastructure management model has been reached. The main research methods were used: analysis and generalization of scientific literature, logical and systematical reasoning, graphic presentation of comparison, abstracts and other methods. RSI means territorial and spatial system of interrelated economical and social activity types (which not directly related to production industry) and relations, establishing proper conditions for ecosystem performance, creation of human, physical and social capitals to be used by individuals and the society itself for their private and social needs. A complex RSI requires the management of various levels. The integrative management model cover application of management processes that integrate some or all fundamental components of scope, schedule, cost, risk, quality and resources. Integrative functions of RSI (planning, monitoring and controlling, information, organisation, stakeholders, assurance) act across those components. Each integrative function brings together aspects of the main components and helps to keep the principles of RSI management. The main elements of the integrative RSI management model identified: determination of consumer demand for RSI services and strategic development goals; RSI

development (planning of services, means and results); organization of RSI services supply; horizontal and vertical coordination of RSI activities; assessment of RSI services consumers' opinion and community sustainability; supervision and evaluation of RSI activities.

**Key words:** social infrastructure development, integrative management, principles of rural social infrastructure management.

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## Social Benefit of Green Spaces to Local Community

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### Abstract

The article deals with the concept of green spaces by highlighting its social benefit to the local community. Green spaces become an important element in shaping rural and urban public spaces, creating attractive living surrounding, promoting integration, interaction and participation of local people, strengthening their health and enhancing overall wellbeing. Green spaces are often characterised as public spaces (places), so the interest in this topic presupposes that being in or using these spaces affect various social groups in any community. According to mentioned both theoretical research methods and specialists interview were applied in this research to solve such scientific problem of this article: in which ways or forms does social benefit of green spaces assert to local community? The object of the research - social benefit of green spaces. The aim of the research is to analyse social benefit manifestation of green spaces to local community. The aim is reached following such research tasks: 1) to disclose the concept of green space and its benefit; 2) to substantiate its social benefit to local community.

**Keywords:** Green spaces, social benefit, local community

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## **Social and Economic Benefits of Agro-ecosystem Services Provision in Lithuania**

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### **Abstract**

Agriculture is an exclusive economic sector related to the use of renewable natural resources in large territory, there is no doubt that it has a significant impact on the formation of semi-cultural ecosystems and on the provision of many ecosystem services in rural areas – healthy food, quality of surface water, air and soil, rich landscape, biodiversity. Agro-ecosystems are human-controlled ecosystems, in which the processes of the natural environment are transformed by agricultural activities. Agriculture is an integral part of the agro-ecosystem, therefore it is particularly important to analyse the processes in agroecosystems, the functions of agro-ecosystems, to reveal the concept of agro-ecosystem services, their social and economic benefits and conditions for their provision. The purpose of the study is to analyse the concept, functions and processes of agroecosystems and to reveal expression forms of social and economic benefits of agroecosystem services. For achieving the research purpose the review of economic studies on ecosystem service approaches, agroecosystems and their benefits was substantiated, the focus on provision of social and economic benefits in agroecosystems was made. The research has revealed the link between the processes in agro-ecosystems and social welfare, allowed to classify agro-ecosystem services according to their public benefit. Analysis of the agro-ecosystem services concept has shown that ecosystem functions or processes become services only when they are beneficial to the

inhabitants. Agro-ecosystem functions reflect their potential for the provision services of the public interest.

**Keywords:** ecosystem services, benefits, agriculture.

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## **A Comparative Study on the Passivity of the Students Learning English as a Second Language at Aleksandras Stulginskis University**

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### **Abstract**

The article focuses on the comparative analysis of the causative factors influencing the student passivity in 2005 and 2017 as well as on classwork methods stimulating their activity. The analysis was based on the results obtained in 2005 and 2017. The results showed that the main reasons of the students' passivity in 2005 during their English classes was their habit to be silent acquired in the high school as well as their unwillingness to show emotions (female approach) and laziness (male approach). In 2017 the students were still unwilling to show their emotions (both female and male approach) and habit to be silent (both female and male approach). In 2005 the active students pointed out discussion as the most acceptable method to acquire competence in the English as the second language, whereas the passive students preferred teamwork to any other classroom activity. Both target groups emphasized the importance of good psychological climate during the classes. In 2017 discussion was found to be the most acceptable method to acquire competence and better speaking skills for the active students and active classwork methods for the passive students, while the latter indicated that the

psychological climate during the classes is exceptionally important helping them to cope with the stress and language barrier. The obtained results also showed that the students in 2017 were more conscious of the importance of being active during the classes.

**Key words:** passivity, classwork methods, motivation, attendance.

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## Use of Territorial Advantages of Municipalities in Podlaskie Voivodeship

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### Abstract:

Sustainable spatial development of rural and urban municipalities concentrate on recognizing and using territorial advantages to support the development of the whole Voivodeship. Rural peripheries are characterized by cultural and natural values what are needed for their use. Sustainable spatial development is aimed at increasing activity and reducing negative effects of population concertation.

The research focused on analyze and evaluate current situation in urban, urban-rural and rural municipalities in Podlaskie Voivodeship. In order to develop sustainable development the analysis of demographic pointers helps identifying special structure of population. The research aim is to ascertain what kind of the demographic differences are in urban, urban-rural and rural municipalities in Podlaskie Voivodeship. The several methods including Mann – Whitney test were used for analysis eight demographic pointers in period of 2010 – 2015. First, the analysis of overall tendencies of indicators was made, then by using Mann – Whitney test the essential statistical differences in urban and rural municipalities were identified. At the end of this research evaluate situation in urban and rural municipalities in Podlaskie Voivodeship the factor analyses

were used to reduce set of demographic indicators to two factors as population income and population age structure.

**Keywords:** spatial development, municipality, Podlaskie Voivodship.

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## **Determinants of Leading of Organic Farms in Malopolska Region**

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### **Abstract**

Poland is a country with significant potential for the development of organic farming. This is due to the possession of rural areas characterized by favorable natural and productive conditions. The advantages of Polish agriculture include relatively clean environment, low chemicals consumption, large labor resources and relatively low labor costs. The main objective of conducted research was to present factors determining the leading of organic farms in the conditions of fragmented agriculture in south Poland. The research was conducted in the Malopolskie Voivodeship in 2017. Source material for analysis was primary information collected using PAPI method. In the survey participated 50 certified organic farms chosen by using purposive method of sample selection. In the area structure of surveyed organic farms dominated farms from 5.1 ha to 10 ha. The most popular direction of agricultural production on farms was the growing vegetables. Owners of organic farms as one of the main reasons for moving the farm from conventional to organic systems, considered the possibility of obtaining subsidies for one hectare of cultivation. These subsidies provide them financial support especially in the first years of operation on the market. The least important reason for transformation a farm from conventional to organic system was the factor associated with the reduction of environmental pollution as a result of the change in system of farming. As one of the advantages of running a organic farm, producers pointed the possibility of selecting disease-resistant plant and animal species and creating additional workplaces. On the other hand, as a basic disadvantage of organic farming, farmers pointed out the difficulties in finding market for the products from the farm. Most farm owners



cooperate with various organizations connected with ecology. Very popular among them are also different kind of training courses, which are aimed at expanding knowledge of organic production. At the same time the educational activity of the surveyed farms is very low. Only in a few farms was conducted educational activity for children or people interested in ecology.

**Keywords:** organic farms, Małopolska

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## Development of Crop Insurance and Its Factors in Lithuania

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### Abstract

Every activity or business experiences successful and unsuccessful periods, also faces some risks. In economics and business practice, more than 220 risk factors are identified. Due to climate change, more and more natural disasters are occurring in the world, and agricultural businesses are heavily dependent on them. Scientists have found that the highest loss of crop yields is due to adverse natural phenomena. In agriculture, one of the most popular production risk management tools around the world is crop insurance. Research aim: to analyse crop insurance, as a mean of controlling production risks, development results in Lithuania as well as to identify and evaluate its factors. After data (2008–2016) analysis of crop insurance development in Lithuania, it can be assumed that the positive development of crop insurance exists, and even though crop insurance is not evenly divided throughout the country, the amount of policyholders, area of insured crops and its share, the insured area by one person and insurance package supply is increasing, moreover country's and EU

financial support for compensations of crop insurance contributions from losses caused by adverse climatic phenomena is ensured. Survey shows that the major factors which restrict crop insurance are bad economic situation, financial inefficiency, not satisfying conditions for crop insurance and loss management system, low reimbursement rates for insurance and excessive bureaucracy. Researchers indicate these fostering factors for crop insurance: reduction of insurance contributions, higher contributions for compensations, more flexible insurance conditions, simpler procedures of reimbursement of contributions, better financial situation.

**Keywords:** manufacturing risk, crop insurance, development, factors, policyholders.

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## Quality Assessment of Selected Accounting Information Systems in Slovakia

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### Abstract

The quality assessment of accounting information systems (AIS) is complicated and important for scientific investigation. From theoretical point of view the difficulties lies in big amount of methods, proposed for AIS quality assessment. From practical points of view most of proposed methods are not suitable in particular situation and it is difficult to eliminate the subjectivity of respondents, participating in the survey.

In the stage of monographic research it was made analysis of scientific publications, dealing with understanding of AIS quality in face with technological progress of information and communication technologies (ICT) and changing of requirements, declared by end-users. In the stage of empirical investigation it was provided questioning of specialists, participating in accounting data processing using three different kinds of applied software and

working in small and medium size agri-food enterprises in Slovak Republic. For processing of received data it was used method of multi-criteria evaluation. Following results of investigation and recommendations provided in standard ISO/IEC 25041:2012 and previous scientific publications it was made assessment of quality of investigated systems, identified strengths and weaknesses of these systems.

**Keywords:** Accounting information systems, quality assessment, multi-criteria evaluation

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## **Non-performing Loans and Proficiency of Microfinance Institutions**

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### **Abstract**

The purpose of this paper is to examine the relationship between non-performing loans and cost efficiency as well as overall efficiency of microfinance institutions (MFIs) by using a sample of 570 MFIs in 67 countries from subcontinent Asia, Latin America, Europe and Africa. We find that non-performing loans correlate positively with MFIs' efficiency, suggesting that if MFIs allow their non-performing loans to increase a bit, they could be more efficient. An important implication for this finding is that, microfinance practitioners should make a reasonable trade-off in order not to put too much emphasis on asset quality at the expense of efficiency.

**Keywords:** Operating cost, non-performing loans, microfinance institutions

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## **Trends of Tourism Sector Clustering in Lithuania**

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### **Abstract**

The article proposes the model to evaluate tourism clustering level and specifies the guidelines for discussion about Lithuanian tourism clustering peculiarities and affecting factors in the frame of actual good practice examples. The theoretical frame of a model is based on sustainability of tourism development and value export.

The significance of tourism clusters is determined by their operations and impact on economic development in emergencing regions of Lithuania. Geographical concentration of interconnected organizations and their activities help to revise the level of tourism clustering. The article provides scientific insights about physical infrastructure, sufficient skills, financial resources, technological challenges, regional competitiveness and practical measures of Lithuanian tourism clustering by explaining emphasizing problems to arising tourism clustering level in practice.

The research methodology is based on display of systematic approach about provided sectoral clustering analysis by the review of scientific literature, Lithuanian and European legal documents, programs and reports for evaluating the financing support mechanism of Lithuanian organizations encouraging the tourism clusters to conduct competitive activities, value export and cooperation, general scientific methods, secondary statistical data analysis of Lithuanian tourism clusters, contingency and factorial analysis for testing tourism clustering level.

Empirical testing reveals the limited functionality of tourism clusters and low integrity into regional and firm-level economic performance. Evaluated factors – prosperity, entrepreneurship and structural changes, importantly scaling the tourism clustering level. The theoretical and empirical analysis of the tourism clustering allows to formulate the scope of tourism clustering solutions, that enables increase the supply of tourism service according tourism clustering level.

**Key words:** clustering, tourism cluster, clustering level, value export.

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## **Not-for-profit Marketing Solutions for Sustainable Development of Public Organizations: Case Study of Lithuania**

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### **Abstract**

The research paper introduces with the not-for-profit marketing function for public organizations management. The contribution of not-for-profit marketing in public sector could be recognized as local authorities' effort to perform in social, economical or environmental programs and projects for improvement of public infrastructure, services or activities by the help of local communities and entrepreneurs. Moreover the commercial marketing successfully implements objectives of business, but not able to influence societal needs and public learning. Commercial marketing impact less social change of awareness, because the programming of socio-economic indicators is oriented on responsive public needs and demand, but the local authorities have difficulties in engaging financial resources for these purposes. The designed traditional marketing tools are expensive for public affairs. Public organizations are flexible in using commercial marketing with great experience to serve for local communities and stakeholders improving service, raising public confidence and satisfaction. Public organizations' efforts to support core public programs, to entail projects for changing behavior of local communities (eg., healthy living program, help for palliative people) or to accept legislation (eg., anti-alcohol control) with the entrepreneurial collaboration is more available.

Aim of research – to identify how marketing operates in not-for-profit environment forming responsiveness and partnerships by creating social value and satisfaction. The research methodology is based on display of systematic approach about not-for-profit marketing concept and definitions, comprehensive review of academic studies, Lithuanian best practices and European reports for evaluating the marketing function and outputs of not-for-profit marketing programs, and general scientific methods to evaluate factors of associated descriptors of not-for-profit marketing for showing public

organizations' experience to adopt not-for-marketing in practice. Evaluated factors – culture, organization, planning, management, knowledge and skills, marketing information and measurements, resources, results and outputs, – are importantly scaling the function of not-for-profit marketing. The theoretical and empirical analysis of application of the not-for-profit marketing function allows to formulate the solutions, that enables increase the impact of public organizations.

**Key words:** not-for-profit marketing, public organizations, non-profit environment.

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## Logistics Risks Management Situation in Lithuania

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### Abstract

More and more companies from all over the world focus on the main business, whereas transport, logistics and storage are entrusted to business partners who specialize in this area. The development of logistic systems creates the need for transport service's risk management. *The aim of this research:* to identify freight transportations' risk management problems in logistic companies. *The objectives of the research:* to distinguish the most important external and internal risk factors and risk management methods applied to logistic companies which provide freight services. *The methodology of the research:* to carry out the study an interview and a quantitative research method – a survey, were chosen. The survey was conducted in March – April, 2017. The questionnaire was submitted to companies that provide freight services with their own or hired transport. The interview method was used to question five executives of freight transport service providers. The main risk factors for the enterprises under investigation are external and internal communication problems.

**Keywords:** logistics, competitiveness, logistics processes, risk management, quality management.

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## **Framework of Vocational School and College Teacher Activities: Motivational Factors, Professional Roles and Application of Educational Techniques in Correlation with Personality Traits**

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### **Abstract**

The relevance of this research is based on the standpoint of the epistemological methodology focusing on the quality of the profession cognition. Therefore, it is presumed that the quality of the vocational education is determined by the variable personal qualities of the teachers (extraversion, openness towards experience and innovation, consciousness, agreeableness, neuroticism). The research object of the current study is the link between the personality traits of the college and vocational teachers and the components of educational content. The research aims at identifying the relationship between the motives of the vocational school and college teacher activities, educational techniques they use, professional roles and their personality traits, as well as identifying the essential differences of the mentioned variables. The quantitative and qualitative research strategies were employed allowing the researchers to perceive and assess the parameters of the relationship between the professional identity of the teachers, meaningfulness in pedagogical work, motivation and educational

content. The research results revealed that a social, external, intrinsic and identified regulation motivation in vocational schools and colleges vary considerably; in colleges social and identified regulation motivations manifest themselves, whereas in vocational schools a lot of demotivating factors, which are related to the problems of vocational student identity, career prestige of a vocational teacher and external motivation, occur.

The role of the vocational school and college teachers in the didactic process also varies: college lecturers identify themselves in the position of the teacher-andragogue whereas the vocational school teachers see their role as a professional (expert). Moreover, the principles of the social constructivism in pedagogy and andragogy are more effective among the college teachers, while vocational school teachers often have to rely on the behaviouristic principles of pedagogy for educational assessment and the enhancement of student motivation.

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## **Characteristics of the Nongovernmental Sector in Latvia**

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### **Abstract**

Nongovernmental organisations (NGOs) have played their role in political processes for centuries, continuing to expand their activity and engage the public. The NGO sector in Latvia is young in comparison with Western countries. The first organisations emerged in Latvia after the country regained the second independence in the 1990s. The NGO sector in Latvia does not differ from that in other countries and has retaining its nature – any organisation is established voluntarily by a group of individuals with similar beliefs to advocate public interests at political level, for non-commercial purposes and with no government influence. Statistical data show the engagement of the public in NGO activities, which is promoted by progress in the world and such opportunities of the digital era as the Internet, mobile applications, social networks or e-platforms that can inform and mobilise the public fast for tackling some problem. As the NGO sector developed and its



scope of activity expanded, new problems were identified, e.g. inability to establish a single system for the activity and financial transparency of organisations.

To exist in a long-term, NGOs need to adapt to a system. Organisations that have built up experience and made achievements represent future potential for new public activists in their work with public administration entities and decision-makers to meet the public's needs and in the interests of the public, thus, in cooperation, making a better and wealthier life for the country's residents.

The research aim is to analyse the NGO sector in Latvia. The research employed the following methods: monographic, descriptive, analysis and synthesis, as well as logical construction.

**Keywords:** civil society; history of NGOs; NGO classification.

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## **Factors Affecting the Human Capital Formation in Logistics Enterprises**

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### **Abstract**

The ongoing structural changes and social-economic transition from the production economy to the knowledge economy Human Capital plays a vital role in developing and creating new ideas and knowledge. Logistics industry is a fastest growing economic activity in Lithuania. The development of the human capital becomes important to secure competitive advantage and improved performance for Lithuanian logistics companies. Logistic companies themselves try to find the solutions how to creation, development and share the knowledge amongst its employees and how strategically develop and manage the own human capital. The aim of research is to examine the contemporary academic perspectives on measuring human capital and the factors affecting its value.

In order to provide theoretical and practical basis of the factors affecting the Human Capital formation in logistics enterprises analysis, a study of the correlation between internal and external factors was conducted. Based on the investigation of 30 respondents from Lithuanian Logistic enterprises, the correlation between 20 factors affecting the human capital value was analyzed via a path and correlation analysis. Correlation analysis results showed that there was a significant negative correlation between the factors of the external environment “Demographic” (as migration, structure of population and others) and factor from the environment of the individual “Family” content, the correlation coefficient was -0.671. And the blade thickness was positively correlated with the factor from the environment of the organization “Culture” and “Value of organization” (+0,695).

According to these results, the focus should be on transforming Human resources management function as well as providing a facilitative environment for the developing the necessary skills in the professional and technical field.

**Key words:** Human Capital, Logistics, Factor Analysis, Correlation Analysis.

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## **The Impact of National Rural Network’s Initiatives on Socio-economic Development of Podlaskie Voivodeship in Poland**

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### **Abstract**

National Rural Network is an important instrument for rural development in Poland. NRN is an instrument of the Rural Areas Development Programme. The main objective of NRN is to support the rural areas of the European Union by providing information, experiences and good practices for sustainable rural development. These measures are intended to improve the quality of life of rural residents and the conditions of their work. The aim of the paper is to demonstrate whether the implementation of NRN initiatives contributes to

socio-economic development of rural areas in Podlaskie Voivodship. In order to achieve this objective, the projects supported by NRN for the years 2010-2017 were reviewed, and the numbers of the projects in individual poviats were compared to the changes in values of socio-economic development indicators derived from the Central Statistical Office data.

**Keywords:** EU funds, National Rural Network, Podlaskie Voivodeship, rural development

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## Citizens Participation in Addressing Local Problems: A Case Study of Republic of Macedonia

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### Abstract

The paper discusses the level of satisfaction of the local government performance and certain forms of citizen's participation in the improvement of the quality of life in the rural communities, such as creating new job positions, improvement of the infrastructure, creating better opportunities for the children, and decreasing of the poverty. Politicians often make big promises before elections while talking about democracy, rule of law and citizens well-being. After their election, however, they forget about the problems of their fellow citizens. Citizens then feel helpless, fall in apathy and hopelessness, and take a distance from politics and the vital questions for their rural community. The paper will show some data related to these issues gathered from a research conducted by the author in 2016 on a representative sample of 640 respondents

on the territory of Republic of Macedonia. The research results show the current situation of the citizen's satisfaction from the local government with respect to the solutions of water supply and sewerage, transport of citizens, opening of new jobs, building of social services facilities, opportunities for culture and recreational activities, and they ways in which the citizens influenced the local government. The results mostly reflect dissatisfaction with the work of the local government in addressing local problems, the underdeveloped mechanism of public participation, low level of human capital in rural local governments and other problems.

**Key words:** forms of participation, satisfaction, local government, rural development, Republic of Macedonia

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## **CETA and Italian Agri-food Products: an Analysis on Compared Advantages of the Main Italian Agri-food Sectors**

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### **Abstract**

At the age of second-generation agreements, the European Union is going to achieve a number of new trade deals, as well as others country, first of all the Comprehensive Economic and Trade Agreement treated with Canada. A significant part of the debating about Ceta is focused on the real need or not to reach new deal and add more liberalization, in particular regarding the Agri-food goods. EU, and above all Italy, can boast a number of excellent export Agri-food processed product, such as wine, cheese and pasta; at the same time, Italy has a need of primary goods, like wheat. Revealed Competitive Advantage is an indicator of the importance of a specific product and, specifically, it's used to identify the advantage or disadvantage of a trade flow. Some of the main Italian products exported in Canada have been analyzed, just like the main imported product from Canada, the wheat; as opposed to EU-28 import of Durum wheat,

the other trades have showed a comparative advantage in trade. Finally, in three cases, Italy proves greater advantages in respect with the EU.

**Key Words:** Agri-food production; Comprehensive Economic and Trade Agreement (CETA); Revealed Competitive Advantage (RCA)

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## **The Territorial Management Contracts as innovative New Governance of the Territory in the Framework of the EU CLLD Programme and Ecosystem Services Policy**

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### **Abstract**

In all the world the question of the good practice to manage of territory is a pillar of the implementations of Sustainable Development Goals 2015-2030. The authors are working in collaboration with a holistic approach at the topic. In this way the Smart Communities and Smart Territories are the new paradigms in 21th Century to solve the question of the adaptation at the Climate Change and to guarantee, for the future generation, the conservation and promotion of all potentialities of each territory and identity of areas. Till now they have use a deductive method to analyse and show, in the framework of the Sustainable Development, the Community Led Local Development (EU Programme for CLLD) and Ecosystem Services, the need to move from an emergency management approach to preemptive territory management.

The results of this research have produced the original and autonomous configuration of a new and innovative strategy and governance based on a model that puts in synergy the three aspects of the framework that has been given the name of Territorial Management Contracts (TMC).

The TMC, appear a possible shared and democratic model that could combine the territory risk management with solutions of development driving and

sharing by the local populations. This innovative approach is strictly linked with the targets of the Sustainable Development Goals 2015-2030 and the Europe 2020 (smart, sustainable and inclusive).

The authors argue that the TMC model is now sufficiently mature to pass from the processing phase to that of the implementation that in the Payment of the Ecosystem Services (PES) finds a concrete reinforcement of the scientific analysis carried out.

**Key Words:** Sustainable Development, Territory management, Ecosystem Services, CLLD, Smart Communities, Smart Territories.

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## Culture Tourism Development in the Rural Regions

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### Abstract

The research covers theoretical analysis of the tourism development in rural regions, as well as the public administration role in cultural tourism sector management in order to evaluate, plan and maintain tourism resources at the region. The problematic question does cultural tourism could substantially contribute to the rural regions' development was investigated. The goal of this research was to investigate public administrations' efforts to support necessary measures for the regional development by empowering possible benefits from culture and other resources usage for the local society and tourist's needs. Population survey method was used in order to define people opinion on public services in culture sphere situation in Lithuanian rural regions. Obtained data analyses enabled to identify needs for necessary projects implementation and to provide recommendation for the strategic planning. Conclusions on the

performed research, as well as some suggestions for the better tourism development management at the regional level has been presented.

Keywords: Culture, culture tourism, rural development, regional policy, public administration

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## **New Product Value for New Brand: Composition Aspect**

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The article analyzes the value of a new product in terms of composition in terms of the value of a new brand. With the help of scientific.

literature systematization and analysis methods introduce the concept of the value of the new product and the value of the composition of the product. Detail the value of the new product composition for the new brand value structure. Recognizing that consumer choice depends on the value of the new composition of the product offered to him by the firm's offer, the practical test of the scientific concept has been chosen from the original study, analyzing the value of the sweets as a new product for the consumer. The results allow us to make assumptions about what elements of the new composition of the product could influence the success of the new brand on the candy market.

**Key words:** New product, value, new brand, new product composition, candy market, customer value

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## **The Production and the Market of the Ecological Products in Poland**

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**Abstract**

The goal of this study is to evaluate the condition and development prospects of ecological farming and its product market in Poland. Sources of data used for the analysis included, eg. IJHARS (Agricultural and Food Quality Inspection) national reports, literature, and information provided by experts and consumers. The time frame of the research covers the years 2004-2020. The date of Poland's accession to the EU 2004, and subsequent formal-legal factors were taken into consideration to schedule the time frame of the research. The trend was analyzed in reference to the number of ecological farms and the area of ecological farmlands as well as ecological manufacturers in 2004-2016. The method of the least squares was used in the study. Parameters of the trend function equation (linear, square) were determined by means of this method. MS Excel calculation sheet was used as a calculation tool. The value of determination coefficients indicated good consistence of the determined trend lines with empirical data. A distinctive linear trend with upward tendency in the number of ecological manufacturers was found in the analyzed period of time. According to the determined trend function, the number of ecological manufacturers could be more than 764 in 2020, that is, reach the expected value according to the assumptions of the Framework Action Plan for Ecological Agriculture and Food in Poland for the years 2014 – 2020. The analyses were confronted with the experts' assessment results carried out by the method of online survey and consumers' assessment by the method of group interview carried out in 2017. Two measurement instruments were prepared, that is, a survey questionnaire and interview scenario. It needs to be noted that although during the last 3 years a drop in eco-production was reported, development of ecological agriculture and its product market in Poland is possible, on condition that the government policy in this field is consistent and predictable, the society becomes richer and the ecological awareness of both farmers and consumers improves.

**Keywords:** organic agriculture, organic food, ecological food, organic market, organic marketing, development, trend function, evolution trend

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## Lipids Accumulation of *Chlorella vulgaris* under Variable Lighting Conditions

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### Abstract

The cultivation of microalgae is now an intensively developed research area. Some species of microalgae under appropriate conditions accumulate large amounts of lipids in the cells, which may be a suitable feedstock for biodiesel production. The cultures of microalgae for lipids production should be cultivated in specific physicochemical conditions. The most important environmental parameters affecting the algae growth are: nutrients, lighting, reaction, turbulence, salinity and temperature. Periodic changes in lighting is a key parameter that have a significant effect on cells density and lipid accumulation. The mechanism of this action depends on intensity of light and its spectral composition. To produce 3<sup>rd</sup> and 4<sup>th</sup> generation biofuels, a better understanding of the relationship between light conditions and yield of lipids accumulation is necessary. The aim of the study was to determine the effects of variable lighting conditions for lipids accumulation of microalgae *Chlorella vulgaris* and to determine the most effective lighting parameters. The study confirmed the possibility of using the lighting shock conditions to maximize lipids accumulation in algae *Chlorella vulgaris* cells. In the study, 33.18% of lipids were obtained from biomass culturing with red light-emitting diodes (LEDs), which was 22% more than obtained with white continuous lighting.

**Key words:** microalgae, *chlorella vulgaris*, photobioreactors, lipids, light, biodiesel

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