

Abstracts

of papers presented at the conference Sustainability and production systems Slovak – Chinese scientific conference 2017

DOI: <http://dx.doi.org/10.24040/actaem.2017.19.1.61-69>

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Selected input and output material flow indicators of phytomass in Slovakia

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Abstract: Agricultural phytomass comprises organic non-fossil material of biological origin generated by a cultivation process which takes place more or less under human control. The general purpose of phytomass material flow analysis is to describe the interaction of the economy with the natural environment, and reflects physical flows from the environment to the economy (input indicators) and discharges from the economy into the environment (output indicators). Material flows within the economy are not represented. Input and output data serve for the input and output material flow indicator processing. We distinguish several input indicators, e.g. domestic extraction used (DEU) of biomass, total imports (TI). Indicators on discharges from the economy into the environment are domestic processed output (DPO), total exports (TE). DPO may consist of emissions to air or water, waste or discharges that result from the dissipative use of products as would be the case in the application of fertilizer. All material inputs into a system over a certain time period equal all outputs over the same period plus the stock increases minus the releases from stock. We found out in Slovakia, in 2010, DEU of 7,804,852 t. DPO quantified as a sum of GHG emissions, waste and waste water from agriculture was 781,824.3 t, of which waste was 486,823 t, waste water was 295,000 t, and GHG emissions was 1.3 t. This work was supported by the Slovak Research and Development Agency under Grant No. APVV-SK-CN-2015-0004.

Key words: material flow, biomass, input indicator, output indicator

Environmental evaluation of Chinese open-field grape production

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Abstract: Along with the production of grape, some harmful by-products are also produced. But they are not included in data envelopment analysis (DEA). Thus the assessment cannot correctly reflect the technical efficiency of open-field grape production system. We measured the environmental efficiency of China's open-field grape production under the constraint of carbon emissions using the slacks-based measure (SBM) model, including the undesirable outputs. In addition, spatial relations of environmental efficiency in different open-field grape production areas in China were evaluated by adopting spatial econometric methods. The results showed that the average environmental efficiencies in southwest region is lower than in other regions, which implies the imbalance in economic outputs, resource consumption in open-field grape cultivation. Moreover, the spatial autocorrelation results showed that the environmental efficiency of grape production has obvious continuity in neighbouring regions and spatial correlation.

Key words: grape production, data envelopment analysis, environmental efficiency

Wine and geology

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Abstract: The oldest occurrence of vine is described from the Jurassic time (150 Ma). *Vitaceae* tribe was considerably widespread in Cretaceous time. The oldest occurrences of *Vitis* are described from Cretaceous time (Sachalin and Kazachstan). *Vitaceae* tribe spread over the whole Northern hemisphere 40 Ma. During the Ancient times the wine was produced in Mediterranean area (mainly in Egypt, Greek and Roman world) also from wild vine but the most cultivated varieties were Muscat and Malvasia. The most important factors for wine quality are microclimate, soil, sun radiation, moisture, and content of some specific elements in the soil (macroelements as Ca, Mg, P, and microelements as Cu, Zn, Cr, Ni, Pb, V). The same vine varieties give different wines if they are produced on granites (e.g. the Beaujolais wine from France or wines from Malé Karpaty Mts. in Slovakia), limestones (e.g. wines from Champagne and Bordeaux regions, in Slovakia wines from Trábeč Mts. or Považský Inovec Mts.), volcanites (e.g. Lacrima Christi from surroundings of Napoli in Italy produced on slopes of Vesuvio volcano or Est-est-est wine from Montefiascone in Italy, Tokaj wines from Hungary and Slovakia), schists (Oporto wines from Northern Portugal), sandy or clay soils (Moscatado do Setúbal from Portugal or Chianti classico from Tuscany in Italy).

Key words: wine, geology, soil, microclimate, history

WSN based food cold chain management

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Abstract: CCM is the management of produce temperature and the atmosphere around it, from postharvest, through to the consumer, to maintain the quality of the product. There have four kinds of atmosphere: O₂,CO₂ from inherited from atmosphere; ethylene released when the products reach maturity as a ripening signal and/or generated from ethephon; special gas, such as SO₂, generated from preservative or imported from controlled atmospheres (CA) or modified atmospheres (MA) can serve to extend their post-harvest-life; some gases, released when the products corrupt, can be used to indicate degree of corruption. Based on those requirement, we developed a mobile e-nose (multiple gas sensors) to provide the online monitoring and/or information record for those selected gas components, analysis the response characteristics parameters and mechanism, calibration method, gas signal processing and quality coupling, develop monitoring and traceability platform. The mobile e-nose had been test and validated at grape, peach, young garlic shoot, apple cold chain.

Key words: cold chain management, controlled atmosphere, modified atmosphere, gas sensor

Quantification of biomass flow and energy potential of permanent grasslands

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Abstract: Permanent grasslands have developed since the Early Middle Age as a result of grazing animals. In addition to feeding ruminants, they are currently serving humanity with another ecosystem services and play an important role in conserving ecosystem stability. Economic transformation after 1990 and compliance with the principles of the Common Agricultural Policy resulted in change of use of grassland area and affected the yield and quality of grassland biomass as well. The objective of this study is to analyse the current state in the use of permanent grasslands in Slovakia, to assess biomass production and show the possible potential of permanent grasslands as a bioenergy feedstock. In 2015 out of 858,601 ha of the area of permanent grasslands, 211,483 ha were grassland habitats under extensive management, 309,098 ha were productive grasslands used to produce forage for ruminants and 338,020 ha were not used for production. Grassland habitats, productive and non-used permanent grasslands could produce in total 927,644 t, 1,854,588 t and 1,014,060 t of biomass respectively. The calculated biomass consumption by a herd of 536,889 of total livestock units (cattle, sheep, goats, horses) at the consumption of 4.5 t of utilizable biomass showed that there was still surplus of 1,380,288 t and 366,228 t of biomass from the total and used area of permanent grasslands, respectively. Total energy content from surplus biomass could reach 24.1 PJ what corresponds to 3.5 % of energy consumption of the Slovak Republic. Nevertheless low quality of surplus biomass could be an obstacle for its use as a bioenergy feedstock. This negative aspect could be overcome by improvement of botanical composition and management of non-used permanent grasslands. Apart of possible increase in energy self-sufficiency, utilisation of permanent grasslands could contribute to sustainable use of natural sources and economic development of rural regions.

Key words: permanent grasslands, biomass, bioenergy potential

Bioavailable fractions of potentially toxic elements at Maximilian Cu-deposit in Špania Dolina (Central Slovakia)

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Abstract: Bioavailability research presents an essential tool, in modern phytoremediation and phytomining technologies, allowing the estimation of plant available fractions of elements in soil. As the one of research areas, mine-dump Maximilian was chosen, which represents the rest of frequent mining activity from the past. In total 8 sampling sites were selected on the dump-field. At each sampling site soil samples from a depth of 0 – 10 cm and samples of plant material were taken. The soil samples were analysed for total concentration of elements, pH (H₂O) and consequently by 5-step sequential extraction (SE) to determine fractions of elements that are mobile (fraction 1), acid soluble (pH 5) (fraction 2), bound to organic and oxidizable matter (fraction 3), bound to amorphous oxides (fraction 4), Fe–Mn oxides (fraction 5) and residual fraction. The highest amount was determined for Cu, as expected – 1283.38 mg kg⁻¹ in avg. From other potentially toxic elements, significant values were measured also for Pb and Zn. Results of sequential extraction shows, that the most of the Cu content is bound to organic and oxidizable matter (fraction 3) – 583.8 mg kg⁻¹ (45 %), while the Pb is mostly present in forms of amorphous oxides (fraction 4) – 36.1 mg kg⁻¹ (57 %). Therefore, the results present the high amounts of potentially toxic elements in the whole investigated area in bioavailable forms that could affect the biotic part of local ecosystem.

Key words: bioavailability, toxic element, dump-field, sequential extraction

The potential of agroecosystem services in Banská Bystrica district

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Abstract: The concept of ecosystem services has become an important tool for modelling interactions between ecosystems and their external environment in terms of global bio-climatic changes. The provision of ecosystem services depends on biophysical conditions and changes over space and time due to human induced land cover and land use. Ecosystem services linked to natural capital can be divided into three services categories (provisioning, regulating and cultural) adding ecosystem functions (structures and processes relevant for ecosystem self-organisation, biodiversity, soil macro-organisms, micro-organisms). Traditionally, agroecosystems have been considered primarily as sources of provisioning services, but more recently their contributions to other types of ecosystem services have been recognized. According to several authors agroecosystems can provide a range of other regulating and cultural services to human communities, in addition to provisioning services and services in support of provisioning. Concept of agroecosystem service combines environmental and socio-economic approach to the analysis and evaluation of natural capital. A large part of the agroecosystems in Banská Bystrica district belong to the category of low and medium potential of provisioning services, with a strong domination of category of medium potential (64,04 % area). The majority of the total area of Banská Bystrica district belongs to the categories of low (41.52 %) and very low potential (42.79%) for regulation of water regime. This district has a high proportion of category of low potential (64.04) to regulate denuding the soil caused by water erosion, whereas the category of very high potential is not presented. The low potential for immobilization of risk elements is present in more than 89% of the total area. Potential of natural conditions for recreation is higher only in agroecosystems with a higher proportion of area of grassland agroecosystems and protected areas NATURA 2000. The majority of the total area of Banská Bystrica district belongs to the high category of potential of natural conditions for recreation. The authors acknowledge the Slovak Research and Development Agency for the financial support via contract No. APVV-0098-12 Analysis, modelling and evaluation of agroecosystem services.

Keywords: potential of agroecosystem services, Banská Bystrica district, ecosystem function

Geogenic factors in soil forming processes affecting soil productivity

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Abstract: Parent material, organisms, climate, relief, and time are considered the five major factors in soil formation. These factors are the main variables that determine the state of the soil, and directly or indirectly also soil productivity. The solid phase, a mixture of inorganic and organic material, makes up the skeletal framework of soils. The inorganic fraction of soils is composed of rock fragments and minerals, primary and secondary, of varying size and composition. Primary minerals are minerals that have been released by weathering from rocks. These minerals constitute the sand fraction of soils. Secondary minerals have been derived from the weathering of primary minerals. They are present in the clay fraction of soils. Most of the minerals are either silicates or oxides. Most of the minerals in the soil clay fraction are phyllosilicates. The composition of soil minerals is very variable and can affect nutrient cycling that preserves and maintains soil fertility. Slovakia is a highly diversified country in respect to its natural environment including parent soil material. It is largely located in the Western Carpathian arc and south part in Pannonian basin. The parent material of Slovak soils is dominantly rich in minerals (app. 50%). About 40 % of substrates are medium rich in minerals and app. 10 % is poor in minerals. Such soils are less fertile and are not suitable for agricultural production. The most fertile Slovak soils, Chernozems, are located in south west. They developed from loess rich in calcium carbonate. They are used entirely as arable land. The most common soil types in Slovakia are Cambisol many of which developed from volcanic substrates. These soils are very fertile. Therefore they are also intensively cultivated and used as arable land or grasslands. This work was supported by the Slovak Research and Development Agency under Grant No. APVV-SK-CN-2015-0004.

Key words: soil, geogenic factor, mineral, soil productivity