ENVIRONMENTAL IMPLICATIONS OF AGRICULTURE IN BIO-ECONOMY CONTEXT

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Introduction

The term bio-economy is a new buzzword in the economic literature. Bio-economy has different stakeholders, covering wide range of sectors of economy on national and international levels. Different countries, regions focus on the different parts to be optimized. As the part of the wider concept, the bio-economy is a step toward the objective of European Commission – the green, resource-efficient and low emission economy. As the discipline based on the natural resources, the main challenges are in the ecological, environmental, energy and food supply sectors like agriculture, forestry, fishery, food and chemicals.

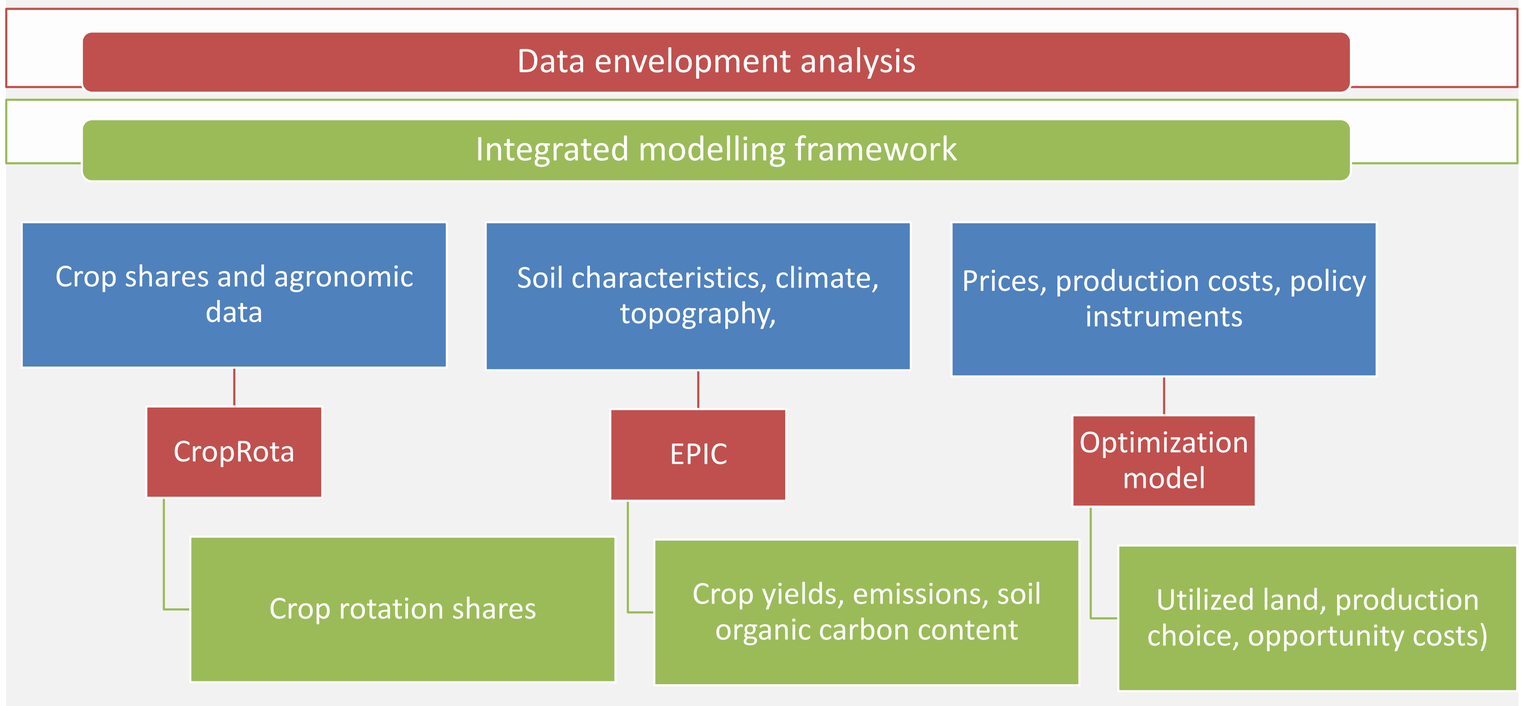
Given the overall goal of European Union to become a leader in terms of resource efficiency and low-emission economy, this research aims to analyze the impact of agricultural industry – especially the crop production, on environment. Agriculture is the sector with potential for environmental impacts mitigation on global scale as it is responsible for a significant fraction of anthropogenic GHG emissions and deforestation. However, it still offers cost-efficient mitigation options to reduce GHG emissions and provide biomass for fossil-based materials substitution. Research is primarily focused on the case of Slovakian agriculture but considers the European perspective as well.

After the accession to European Union, the agricultural land became a part of European natural resources and therefore also the part of economic, ecological and social potential with requirements of functional soils, their protection and the accurate use. On the the priorities of multifunctional agriculture is optimal ways of using natural resources in field systems, input-output analysis and their rations. The aim of research topic is to develop integrated modelling framework which combines bio-physical and economic optimization models. The integrated modelling framework is developed to analyze different cost-effective crop production choices following the methodology of optimal programming. The model integrates agroeconomic and bio-physical data into a regional bottom-up and land use optimization model to account for heterogeneity in opportunity costs of agricultural production choices.

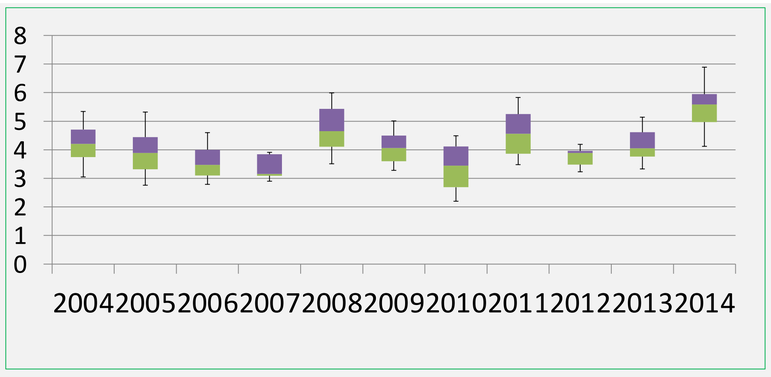
Methodology

Data and models:

- The European Union agriculture database
- DATAcube-sector statistics
- National Agriculture and Food Centre of Slovakia
- Soil Science and Conversation Research Institute



Results



Box and Whisker plot showing the development of yields for cereals is caputred in Fig. 1. Western regions produced the highest yields among all regions. In the year 2014 there were highest yields over the observed period ranging from 4.12 t/ha in wastern regions to 6.89 t/ha in western regions. 50% of regions have the yields between 5 t/ha and 6 t/ha. Mostly variability is unfluances by floods in regions of southern and eastern part of Slovakia.

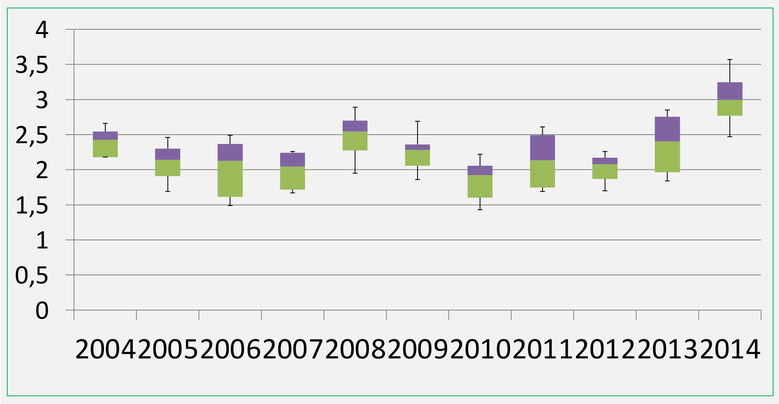
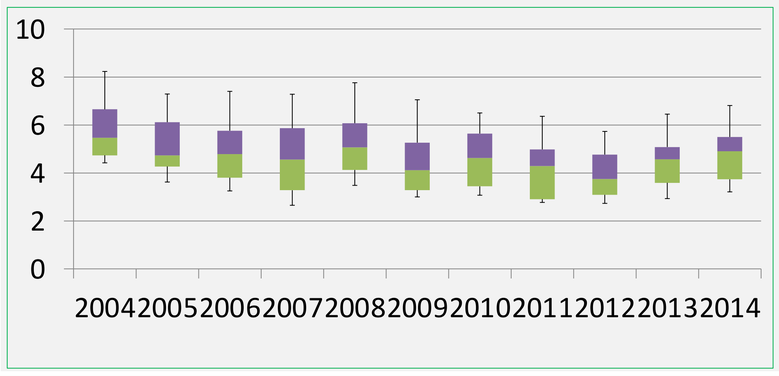


Fig. 2 represents plot for yields development in category of oil-crops. Over the whole period the yields in regions were ranging between 1.4 t/ha and 3.6 t/ha. Again the highest observed yields in most regions occurred in 2014, when 50% of regions produced the oil-crops between 2.7 t/ha and 3.3 t/ha. The central region is with the lowest oil-crop yields, where yields were ranging between 1.52 t/ha in 2010 and 2.61 t/ha in 2014.



The different development can be seen in case of Fig. 3. Plot shows that the average yields were ranging between 2.8 t/ha and 8.2 t/ha. The highest average yields occurred in 2004. 50% of regions had the yields between 4.8 t/ha and 6.5 t/ha. The difference of fodder crops is that they are harvested more times a year. The variability among the regions is much higher over the observed period, what imply the different natural conditions.

Main conclusions

Slovakia belongs to the countries with significant space to improve environmental efficiency of agriculture. The dominated sector is crop production. The major part of arable land is devoted to the cultivation of cereals (57%), followed by feed crops (20%) and industry crops (19%). Slovakia has a technical and bio-physical potential for biomass production expansion. It is though important to identify the optimal production choices, the opportunity costs and environmental outcomes.

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