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ECOLOGICAL FOOTPRINT AND BIOCAPACITY

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Abstract

Agricultural production is affected by how natural resource is managed. Governments using ecological footprint are able to assess the ecological value of assets. Ecological biocapacity (EB) includes five sub-categories: cropland, grazing, forest, fishing and built land. Ecological deficit means that the ecological footprint is larger than the country's biological capacity. The paper discusses the ecological footprint, biocapacity and share of energy from renewable sources in the following countries: Hungary, Romania, Serbia, Bosnia and Herzegovina, Croatia, Bulgaria, Austria, Greece, Italy and Macedonia (FYR). It is obvious that Hungary has the highest value, while Macedonia has the lowest ecological footprint. Austria has the largest share of energy from renewable sources, while Bulgaria has the lowest share in relation to the other analyzed countries. The author emphasizes the importance of measuring investment in natural resources and their impact on agriculture. Farming practices and greening of technologies in agriculture include, for example, enhancing soil fertility, improving the efficiency of water use, reducing the use of chemical pesticides and herbicides. Sustainable management of natural resources is very important for the "green" development in agriculture and energy production. This is one of the ways to provide resources and security for future generations.

Keywords: *ecological footprint, biocapacity, green agriculture*

Introduction

There is no area of man's social and individual life in which globalization has such local implications as it has in the sphere of environment conservation. The ever-growing ecological problems, have become universal global problems, and the ecological crisis has turned into global crisis. Sociologists have been warning that the modern society has found itself in confrontation with fundamental life principles (*Nikolić & Galjak*, 2009). In today's world, where humanity is already exceeding planetary limits, ecological assets are becoming more critical. Each country has its own ecological risk profile. Many are running ecological deficits, with footprints larger than their own biological capacity. Others depend heavily on resources from elsewhere, which are under increasing pressure (*Footprintnetwork*, 2012). Natural capital accounting can provide detailed statistics for better management of the economy. For example, land and water accounts can help countries interested in increasing hydro-power capacity to assess the value of competing land uses and the optimal way to meet this goal. Ecosystem accounts can help biodiversity-rich countries design a management strategy that balances tradeoffs among ecotourism, agriculture, subsistence livelihoods, and ecosystem services like flood protection and groundwater recharge (*Riznić et al.,* 2010). Business companies in earlier times were focused on achieving growth in the volume of production as a base for increase in profits. Increase of the physical volume of production in response to the growing needs of consumers and society, caused a disturbance of the environment by increasing pollution of the environment, but also increased awareness of environmental protection (*Premović et al.,* 2011). Sustainable management of natural capital

underlies green growth in key sectors, such as agriculture, manufacturing and energy is vital for resilience and welfare gains (*The World Bank*, 2012). Serbia should follow the practice of developed European countries and their know-how in the field, which is of invaluable importance (*Riznić et al.,* 2010).

Materials and methods

The paper discusses the ecological footprint and biocapacity, share of energy from renewable sources/patents - renewable energy, based on data from Global Innovation Index and the OECD in the following countries: Hungary, Romania, Serbia, Bosnia and Herzegovina, Croatia, Bulgaria, Austria, Greece, Italy and Macedonia (FYR). The Ecological Footprint is a resource accounting tool that helps countries understand their ecological balance sheet and gives them the data necessary to manage their resources and secure their future (*Footprintnetwork*, 2012). The simplest way to define ecological footprint would be to call it the impact of human activities measured in terms of the area of biologically productive land and water required to produce the goods consumed and to assimilate the wastes generated. More simply, it is the amount of the environment necessary to produce the goods and services necessary to support a particular lifestyle (*WWF*, 2012). Biocapacity is shorthand for biological capacity, which is the ability of an ecosystem to produce useful biological materials and to absorb carbon dioxide emissions (*Footprintnetwork*, 2012). In many parts of the world, agriculture is damaging its natural resource base. In low-input farming, characteristic of the poorer parts of the developing world, the main concerns are soil depletion, water scarcity and habitat loss due to over-cropping, over-grazing and deforestation. In many developed countries, high-input farming practices and farming on environmentally fragile lands are responsible for soil and water depletion; nutrient pollution of groundwater, internal waterways and estuaries; reduced agricultural and natural biodiversity; and landscape degradation (*OECD*, 2008). The paper emphasizes the importance of indicators for measuring progress towards green agriculture. Research results are presented in graphs and table.

Results and discussion

The bridge between ecology and economy is sustainable growth and development whose essence is growth that meets the current needs while using rationally natural resources to ensure meeting the needs of future generations. Ecological management is a new concept for solving environmental problems which include organizational structure, processes, procedures, resources for the implementation of environmental policy and accountability in the region (*Premović et al.,* 2011). We can see the difference in ecological footprint and biocapacity in the analyzed countries (Figure 1).

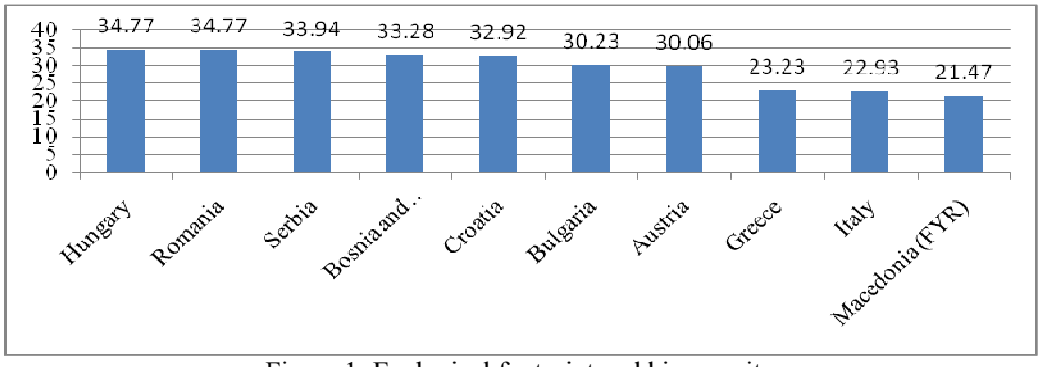

Figure 1: Ecological footprint and biocapacity

Source: Author based on Global Innovation Index, 2012.

In some areas of the world, the implications of ecological deficits can be devastating, leading to resource loss, ecosystem collapse, debt, poverty, famine and war (*Footprintnetwork*, 2012). By adopting the National Strategy for Sustainable Development in 2008 the Republic of Serbia has accepted that sustainable development becomes its permanent development orientation and of course one of the prerequisites for entry into the family of modern European states (*Nadić*, 2011). Urged on by WWF, countries in Eastern Europe made major commitments toward protecting the Danube-Carpathian region. Progress this year included a declaration by Austria, Croatia, Hungary, Serbia and Slovenia to create the world's first five-country protected area around the Danube, Drava and Mura rivers, and a seven-country sustainable forestry protocol that will protect old-growth forests (*WWF*, 2012). Necessity of regulated and environmentally friendly behavior of economies becomes clear at times of enormous population growth and economic development depleting natural resources and planet's biodiversity. Biodiversity, *i.e.* variety of species and diverseness of ecosystems, is the main prerequisite of planet's survival (*Riznić et al.,* 2010). Patents are important in the implementation of new solutions and it is evident that Greece had the highest values as compared to the other analyzed countries (Figure 2).

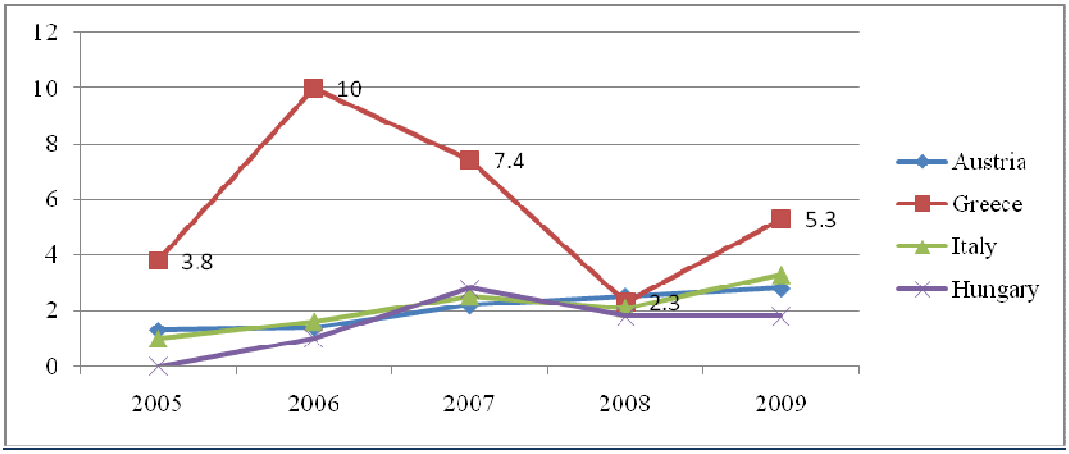

Figure 2: Patents - Renewable energy, %

Source: Author based on OECD databases, 2012.

Renewable sources include: hydro, geothermal, solar, wind, tide, renewable combustibles, and waste. Although the idea of sustainable development should be approached from a critical standpoint, there is no doubt that by its political ignorance in the politics of the Serbian government it loses the necessary and costly time needed to strengthen the process of environmental protection and modernization of the society in Serbia (*Nadić*, 2011). The difference between the highest and lowest share of energy from renewable sources in the analyzed countries is 13.99 % (Figure 3).

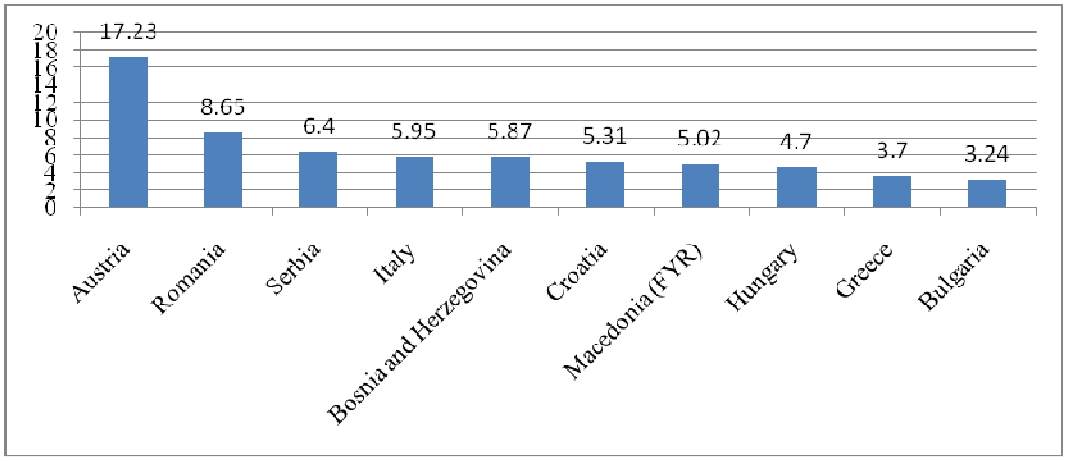

Figure 3: Share of energy from renewable sources (%)

Source: Author based on Global Innovation Index, 2012.

Companies that want to work successfully must respect the presumption of sustainable development and environmental standards in planning their business activities and defining the goals (*Premović et al.,* 2011). Environment is the surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation. Environmental objective is overall environmental goal, consistent with the environmental policy, that an organization sets itself to achieve. Environmental Performance Evaluation (EPE) ensures that any business can continually monitor and improve environmental performance (*Štrbac Maja,* 2008). Ecosystems accounting not only provides a tool to maximize economic growth but is also a means to measure who benefits and bears the cost of ecosystem changes, helping governments gauge whether their growth is inclusive (*The World Bank*, 2012). National governments using the Footprint concept are able to: assess the value of their country's ecological assets; monitor and manage their assets; identify the risks associated with ecological deficits; set policy that is informed by ecological reality and makes safeguarding resources a top priority; measure progress toward their goals (*Footprintnetwork*, 2012).

Table 1: Potential indicators for measuring progress towards green agriculture

Action indicators	Outcome indicators
Number of enacted and implemented policy measures and officially approved plans that promote sustainable agriculture (including trade and export policy measures, payment for ecosystem services through agriculture, etc.).	Percentage and amount of land under different forms of green agriculture (organic, GAP-good agriculture practices, conservation, etc.).
Level of governmental support to encourage farmers to invest in conversion to green agriculture and get the farm and the product certified.	Decline in use of agro-chemicals as a result of conversion to green agriculture; and the number and percentage of farmers converting to green agriculture.
Percentage of agricultural budget that is earmarked for environmental objectives.	Increasing proportion of Payments for Environmental Services as a percentage of total farm income.
Proportion of available producer support utilised for environmental objectives as a percentage of total agricultural producer support.	Number of agriculture extension officers trained in green agriculture practices.
Approved measures that reduce or eliminate barriers to trade in technologies and services needed for a transition to a green agriculture.	Number of enterprises set up in rural areas, especially those that produce local natural agricultural inputs, to offer off-farm employment opportunities.

Source: UNEP, 2011.

Important contributions to the economy of natural capital like forests, wetlands, and agricultural land are not fully captured in national accounts or may be hidden. Forestry is an example-timber resources counted in national accounts, but forest carbon sequestration is not included. Other services like water regulation, that benefits crop irrigation, are hidden and the value is (wrongly) attributed to agriculture in a country's GDP (*The World Bank*, 2012). Farming practices and technologies that are instrumental in greening agriculture include: restoring and enhancing soil fertility through the increased use of naturally and sustainably produced nutrient inputs; diversified crop rotations; and livestock and crop integration; reducing soil erosion and improving the efficiency of water use by applying minimum tillage and cover crop cultivation techniques; reducing chemical pesticide and herbicide use by implementing integrated and other environmental friendly biological pest and weed management practices; and reducing food spoilage and loss by expanding the use of post-harvest storage and processing facilities (*UNEP*, 2011). Ecological Footprint data show that humanity is using resources and producing CO2 emissions at a rate 44% greater than what nature can regenerate and reabsorb. This gap, known as ecological overshoot, results in the depletion of the natural capital that all species, depend on for their livelihood. It also results in the accumulation of carbon dioxide that leads to climate change, with profound implications for ecosystems and the species they support as well as for our societies well being and economic stability (*Footprintnetwork*, 2012). The greening of agriculture refers to the increasing use of farming practices and technologies that simultaneously: maintain and increase farm productivity and profitability while ensuring the provision of food and ecosystem services on a sustainable basis; reduce negative externalities and gradually lead to positive ones; and rebuild ecological resources (*i.e.* soil, water, air and biodiversity natural capital assets) by reducing pollution and using resources more efficiently (*UNEP*, 2011). Preservation of biodiversity calls for principles of ecological economy, action plans for local communities, as well as revision of national income accounting principles in order to include amortization of natural assets. Inability to predict long-term effects also calls for caution (*Riznić et al.,* 2010). The concept of sustainable development combines the dual aims of improving the present conditions for much of the world's population and providing for the needs of future generations. However, current land management efforts to address a multitude of interrelated problems, including deforestation, desertification, air and water pollution, and uncontrolled expansion of human settlements in urban and rural areas, are hindered by a piecemeal and uncoordinated approach, often with duplication of effort or conflicting sectoral goals. A more holistic and integrated approach would improve land management for agriculture and other uses (*OECD*, 2008).

Conclusion

Governments, senior officials and civil society need to promote the economic, social and environmental future development. All this is to ensure adequate management of natural resources, ecosystem conservation, sustainable patterns of consumption and production, equitable economic growth (poverty eradication), increasing the basic standard of living and more. Climate change has a negative impact (especially in developing countries), which requires urgent and ambitious actions. Agricultural production depends on the available natural resources (energy, land, water, forest). Agriculture consumes fresh water and the land. Also, agriculture uses fuels, for example, transport and pumping water for irrigation. Austria has the largest share of energy from renewable sources (17.23%), while Bulgaria has the lowest share (3.24%) of the analised countries. Countries should formulate regional development objectives to create opportunities (*e.g.*, improvement of production capacity) for all residents, reducing inequalities and fostering balanced development. All countries are

responsible for regulations respect proper use of the opportunities at regional, national and local levels, significantly affect the lives and future of people.

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