Chapter 2
Climate Change and Sustainable Development in Agriculture and Forestry

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ABSTRACT

Although climate change is a global process, its local impacts are diverse. Existing agro-ecological conditions, structure of production, various production systems, technological development, socio-economic factors, and international competition and policy choices will determine the impact that climate change will have on the agricultural and forestry sectors and their adaptive capacity and mitigation potential. The authors use the Danube basin area in Serbia as a case study to test the hypothesis that only sustainable agriculture, based on optimum balance of different types of farming systems and practices and satisfying a range of the region's specific ecological, social, and economic functions, as well as sustainable forestry, can cope successfully with the climate change. The main topics of the analysis are the climate change trends and impacts on agriculture and forestry and the assessment of their adaptive capacity and mitigation potential, including the proposition of relevant adaptation and mitigation measures.

INTRODUCTION

The higher temperatures and changes in seasonal precipitation patterns and in the frequency of extreme events will have consequences for the availability of water resources, soil quality and pests and diseases outbreaks, leading to significant changes in the vegetative cycle, crop yields and livestock productivity and, consequently, in the volume, quality and stability of agricultural production, its capacity for environmental services providing and farm incomes. On the other side, as an important source of nitrous oxide and methane emissions which contribute to global warming, agriculture can contribute to climate change

DOI: 10.4018/978-1-4666-4852-4.ch002

mitigation by reducing its emissions, enhancing carbon storage in farmland soils and producing biomass as a source of renewable energy.

Forests are also climate-sensitive systems and have been strongly influenced by increasing temperatures and reduced precipitation during the summer period, boosting the risk of forest fires, pests and diseases attacks, changes in forest biodiversity and loss of productivity. Forests have also very significant role in carbon sequestration and biomass production and, in this sense, in the mitigation of climate change.

The average air temperature in the period 1951-2004 raised by 1.5 °C/100 years on more than two-thirds of Serbian territory. Temperatures have risen more rapidly in the last two decade than before. The increase was significant for northern Serbia, Belgrade region and the Negotin plain. The precipitation trend in the period 1951-2005 was negative, particularly in the eastern part of the country, with maximum intensity in Negotin plain where annual precipitation decreased at a rate of over 30% N1961-1990 for 50 years (Popović, 2006).

Since the mid-1980s, occurrence of tropic days and more frequent occurrence of heat waves (several days >40°C), drought and floods have also been observed. Assessment of climate change in the future obtained by regional climate model integrations show that further annual mean temperature increase and deficit in precipitation can be expected.

According to the evaluation of drought impacts on the crop yields in east Serbia in the period 1989-2000, the average drop in yields was 40.9% in comparison to the average annual yields in the years without drought Assessments obtained from crop production models show that in second half of this century drop in yield for some crops can be expected to be up to 10% (INCRS, 2011).

Sub indicators, decolorisation, defoliation and combined damage are very important for monitoring of forest trees health. According to ICP Forest monitoring, in the period 2006-2009, the widespread broadleaf tree species *Caprinus betulus L.* (*European hornbeam*) had an increase in defoliation (MESP, 2010).

The analysis in the chapter is dedicated to the sustainability of agriculture and forestry and, particularly, to its vulnerability/mitigation potentials to the climate change in the Danube basin area in Serbia. According to the draft National Synthesis Report for the Rio+20 Conference, sustainable land use in agriculture and renewable energy sources are among key sectors and the Danube region among the key areas of sub-regional co-operation in the development of Green Economy (Mihajlov, 2012).

Much of the high quality agricultural resources and food processing capacities of the Republic of Serbia are concentrated in the Danube basin area. A variety of agro-ecological resources and socio-economic conditions allow the development of various agricultural production systems – from the intensive crop production on the Upper Danube and Kljuc-Negotin plain, and intense conventional and organic fresh food production in Belgrade-Novi Sad metropolitan, to extensive livestock grazing and traditional, integrated and organic production of local meat and dairy products, fruit and grapes in the HNV farmland areas along the Danube river (Popović et al., 2012).

Forested areas and forest production potential are also very various – from the floodplain forests of poplar and willow in the Upper Danube and the limited area of beech and oak forests in the metropolitan fringe to the large area of high value forests in the Carpathians.

Agro-ecological resources and infrastructure (climate, soil, water, biodiversity, hydromelioration systems, etc), land-use structure and changes, agricultural production systems and practices and farm structure, including potentials and constraints of biomass production and use, as well as socio-economic conditions in the three above-mentioned Danube basin sub-areas (Upper Danube, Belgrade-Novi Sad metropolitan and Lower Danube area), will be subject of assessment hereinafter, in the